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TABLE OF CONTENTS

Celebrating 50 Years of Telephony
J. D. Ellsworth

The Young Man and Modern Business
D. F. Houston

"Member Bank" Statistics
J. H. Leighton

Lines of Communication in the Great War
F. H. Fay

Economic Notes, First Quarter 1927

Abstracts of Recent Technical Papers from Bell System Sources

Notes on Recent Occurrences

Organization Changes

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Celebrating 50 Years of Telephony

An address delivered before the Accountants' Theories and Talks Club in New York, January 26, 1927

THE jubilee year of the telephone which has just come to a close was marked throughout the Bell Telephone System by events which commemorated the historic past and other events which were in themselves history makers.

March 7, the fiftieth anniversary of the day when Alexander Graham Bell received his first telephone patent was signalized by a successful test of transatlantic radio telephone transmission. For four hours the representatives of the New York newspapers conversed with London newspaper men as easily and as clearly as if no ocean intervened. This test was the result of years of intensive research and development by technicians who were proud to be known as Bell engineers.

A day even more famous was March 10, 1876, when Bell put his lips to the telephone and said: "Mr. Watson, come here. I want you." Mr. Watson heard and responded to that first sentence which the telephone ever carried.

Fifty years afterwards, that historic day was uni-

versally celebrated by telephone companies throughout the United States. Public meetings were held, central offices were thrown open to the public, and an appropriate insignia marked telephone men and women as participants in the jubilee.

Boston was the scene of Bell's patient efforts and brilliant successes, and in consequence, as was fitting, a special celebration was held in that city on April 15. A large audience, including state and city officials, and many distinguished men, gathered at the Boston City Club. A feature of the occasion was a talking motion picture presenting Thomas A. Watson, as he told, as the only eye witness could, of Bell's early experiments and of his dramatic discovery of the telephone principle. For those gathered in the assembly room, it was as if Mr. Watson was actually present. This was probably the first time that a talking movie was broadcast, yet so successfully was it done that friends of the speaker listening in their homes could hear his words and recognize his voice as it was picked up from the record by the radio microphone. When General J. J. Carty called the roll of the cities along the transcontinental line from Atlantic to Pacific, this also was broadcast and heard not only by the assembled audience but also by listeners throughout New England.

Bell's telephone first received public recognition at the Centennial Exposition held in Philadelphia in 1876 in commemoration of the signing of the Declaration of Independence. The story of how the discouraged young inventor was greeted by Dom Pedro of Brazil and brought to the appreciative attention of the visiting scientists is well known. When the Sesquicentennial became assured, it appeared that nothing could be more fitting than that the Telephone System which bears Bell's name should be represented at Philadelphia, there to give account of its fifty years of progress. Many plans were considered but the one happily adopted provided a miniature theatre, in which were illustrated modern

methods of telephone operation, not only by telephone people, but also by talking motion pictures, a recent development of Bell engineers. There were also exhibited early telephone instruments and models of an up-to-date central office. That this exhibit was a success was evidenced by the attendance of nearly 200,000 visitors and by the award of a Grand Prize "In recognition of the epoch-making development and the continual improvement of a nation-wide means of direct communication unified by the Bell System."

While this exposition was in progress, the same talking motion picture system shown there was put into commercial use as the Vitaphone and amazed theatregoers throughout the land. While the theatrical use of the Vitaphone is quite separate from the telephone business, the principle upon which it operates is an outgrowth of the telephone principle and the development of a successful system of synchronizing recorded sound and motion photography was developed in the Bell Telephone Laboratories.

An event of historic interest was the presentation to the Smithsonian Institute at Washington of a bust of Dr. Bell, the work of the well known sculptor, Victor Salvatore. In the presence of the Board of Regents, a very distinguished body, the bust was unveiled by Mrs. Gilbert Grosvenor, Dr. Bell's daughter, the presentation being made by Walter S. Gifford, President of the American Telephone and Telegraph Company, and the acknowledgment by Chief Justice William H. Taft, who is also Chancellor of the Smithsonian Board.

The inauguration of the New York, Chicago and St. Louis cable was another incident of this memorable year, insuring as it does, a more dependable and satisfactory communication between the west and the east. Participating in this ceremony were the heads of the Chambers of Commerce of the three cities, New York, Chicago and St. Louis, which by the means of this cable were bound in a stronger union.

Work on the northern transcontinental telephone line, furnishing a third and more direct route between the east and the Pacific Coast cities of Seattle and Portland, was carried on during 1926 so that it could be formally opened for service early in 1927.

Progress was made in extending the telephotograph service by which pictures are sent over telephone wires. At the end of the year a daily service was maintained across the continent, and cities as far south as Atlanta and Los Angeles were nearly ready to be added to the system.

While the arrangements for opening transatlantic radio telephone service between London and New York were largely completed during the semi-centennial year, the actual culmination of the many years of work on this project did not come until early in January. The successful projection of the human voice across the Atlantic, for practical telephone conversation, was given a rank in the history of communications alongside of the opening of the first transatlantic telephone cable.

It was significant that during this prolific semi-centennial year Dr. Thomas A. Watson, the assistant of Dr. Bell in his early telephone experiments and now the oldest telephone pioneer, issued an interesting autobiography, "Exploring Life." This book is rich in reminiscences of interest to telephone men. Another notable book which appeared during the year was "The Telephone Idea, Fifty Years After," by Arthur Pound of the *Atlantic Monthly*, a book which well epitomizes the growth and significance of the telephone as a servant of mankind.

Throughout the year newspaper and magazine articles and advertisements carried to all the people of the United States, the story of the telephone in all its phases and gave the nation an understanding of the jubilee year and an appreciation of its significance.

Throughout the year also celebrations were held in hundreds of individual cities and towns, commemorative

of the opening of telephone service in these places. The first telephone subscribers who were still to be found, met some of the earliest telephone employees, to tell of the small beginnings of telephone service. Prominent citizens and telephone officials of today listened to these tales and vied with one another in recounting how the community and the telephone service had grown together and helped one another to grow. These friendly get-together meetings played no small part in the celebration of the telephone's semi-centennial.

In these various ways recognition was given to the first half century of telephone history. That it is a splendid, soul-stirring history none will deny. In the working lifetime of men who are still alive and active, there has been built on the foundations laid by Bell and his colleagues, a nation-wide telephone system which is already becoming international, and an institution designed for public service of such useful and intimate characteristics that its office has well been compared to that of the nervous system of the human body.

Beginning with but little knowledge and against many obstacles the telephone pioneers have erected this splendid structure. Yet we are told that greater achievements will mark the next fifty years which will round out the first telephone century.

The scientists and engineers tell us that the telephone in 1976 will be so improved that it will hardly be recognized as a relative of the telephone of today. Revolutionary changes are confidently predicted as new laws of nature are discovered and new materials are brought forth from nature's vast storehouse. We are likened to miners working a vein of virgin gold which grows in richness as we continue our labors.

With the present accumulation of knowledge and experience, with an organization unsurpassed in size and well equipped with able men and women, with ample resources for development and growth, and with a will to

seek always the best which the telephone art can be made to yield, the telephone accomplishments during the next 50 years should be worthy of our greatest enthusiasm and may well be beyond our present day imagination.

JAMES D. ELLSWORTH.

The Young Man and Modern Business

The following is substantially a reproduction of the informal talk by Mr. David F. Houston to students and others at the 1926 Conference on Business Education called by Stanford University.

NOTHING is more clear in regard to the training of the young man for modern business than that it is a problem demanding the attention, not alone of the young man or of the institution which has undertaken to provide this training, but of business in general.

For the Bell System, this is a real, practical, vital problem. Every year the Bell System takes one out of every twenty-two college graduates; one out of every thirteen technical graduates. It takes from 900 to 1,200 or 1,300 college graduates annually. Clearly its interest in the training of these graduates is much more than an academic interest. It is part of its business to obtain the clearest possible understanding of this problem, from its own standpoint. It is not less a part of its business to obtain, as nearly as it can, a sympathetic understanding of the problem from the viewpoint of the educational institution and from that of the young man himself.

As nearly as we can fix a definite date, the year 1876 marks the beginning of the era of modern business. In 1776 we declared our independence of a political power. It begins to look as if in 1876 we declared our independence of nature, or, rather, as if we declared our determination to control nature and make her serve in a higher and higher degree our purposes.

Fifty years ago business and its processes more nearly approximated those of several centuries before than conditions today approximate those of fifty years ago. Everything we used, except clothing and shoes and a few other things of the sort, was locally produced and locally distributed. All the meat we had was locally

produced and locally consumed, if one had the maxillary power to consume it. Chickens and eggs and vegetables were locally produced, and such fruit as we had. We had vegetables and fruit only in season.

A Half-Century of Change

In 1876 we had few typewriters. We had no electric lights, no electric power. We had no electric railways. We had no telephones. We had no automobiles, no aeroplanes, no radios, no "movies." We had few railroads, and those we had were very inferior. Traveling on them was an adventure. One could never tell whether he would get where he was going or not, or when he would get there, fifty years ago.

In 1876 there was a genius who had been working in his laboratory trying to perfect a device that he called the harmonic telegraph, and he produced the telephone. The arc light was developed in that same year and commercially used two years later. Thomas A. Edison had set up his laboratory in Menlo Park in 1876.

Today typewriters are so numerous that the art of writing by hand is disappearing. The electric plants have developed to the point where they represent an investment of seven and three-quarters billions of dollars; public utilities, twenty billions of dollars; telephones, more than three billions of dollars—developed to a point where a person in this country who can use the instrument can, within a reasonable time, talk to any other person in the nation, or can send his voice across the ocean to England; where one can telephone one's photograph across the continent.

We are spending seven hundred millions of dollars a year on "movies"—as much as the ordinary expenditures of the federal government before the Great War—and about four hundred millions of dollars a year on radio.

Vast Economic Advances

In 1876 we had a population of 45,000,000 people; today over 117,000,000. Then our national wealth was $40,000,000,000; today it is $360,000,000,000. Our exports fifty years ago were about $600,000,000; last year they were about $4,800,000,000. The number of our savings bank deposits fifty years ago was about 2,000,000; today it is 45,000,000 for $23,000,000,000. Our insurance policies then numbered 700,000; today they number 98,000,000, with insurance written approximately in the amount of $70,000,000,000, fifteen billions more than the pre-war wealth of France. We then produced about 2,000,000 tons of pig iron; today we produce 37,000,000 tons. Then we produced 383,000,000 gallons of petroleum; now, 32,000,000,000 gallons.

Our manufacturing products were valued at $4,000,000,000 then; today at $75,000,000,000. Then we spent $83,000,000 on education; and now we spend over $2,000,000,000, or more than all of the rest of the world combined for which statistics are available.

Today we produce 39 per cent of the world's coal; 50 per cent of the world's lumber; 54 per cent of the world's copper; 60 per cent of the world's cotton; 56 per cent of the world's pig iron; 72 per cent of the world's petroleum; and we consume 70 per cent of the rubber. We have 36 per cent of the railroads, and about 60 per cent of the world's telephones and telegraphs. We have 81 per cent of the world's automobiles; and nearly 50 per cent of the world's gold.

Yet we have only 6 per cent of the world's population.

Greatness Through Unity

Now, how is it that this nation of 117,000,000 people has such a large percentage of this material wealth? There are two controlling factors. The first was indicated by Washington when he spoke of the unity of government as the main pillar of our liberty and pros-

perity. Then he referred only to the thirteen colonies; and now we extend from ocean to ocean with a unity which permits any individual anywhere, who has the brains or the means, to utilize anything anywhere in the nation. This unity is one thing which has made this nation economically great.

Think of Europe for a moment. There are twenty-eight nations in Europe. Sixteen of them have an average area which is the same as that of South Carolina; and an average population equal to that of Ohio; each with its nationalistic aspirations, its separate governmental set-up, its jealousies and hatreds, and its trade barriers.

Suppose you were to divide the United States east of the Mississippi into sixteen such nations. We would not know how to transact business.

The other factor, and it seems to me an even greater influence, was what Lincoln indicated when he said that the thing which would make this nation great was the promise we held out that we would lift the weights more and more from the shoulders of the average man and give him a chance; and we have measurably made good in this respect, as is shown by the fact that we spend more than all the rest of the world combined for education and by prevailing standards of living.

Now, not only is it true that this country in fifty years has had a phenomenal economic growth and has reached the stage where its wealth, its standard of living, and its productive powers are the amazement of every intelligent foreigner who visits it; but it is also true that the forces seem to be promising to work in many directions with further acceleration.

The Importance of Imagination

This outline of the changes that have taken place in business within the past fifty years, within the memory of many men now living, serves to emphasize the point that young men and women who are preparing them-

selves for business must, first of all, prepare themselves to use their imaginations while they are reacting on facts. Very few business men have had enough imagination to keep up with America; and any man who tries to do business—especially a business of any considerable magnitude—without knowing the past and the processes and forces now at work, and without trying to imagine the future is likely to be at best an unsatisfactory handler of his enterprise.

During the organization of the Federal Reserve System, we had as a witness a member of one of the largest enterprises in America. I asked him how many banks he would create. He said, "The minimum." I asked him why and he said, "Because there are not enough banking resources in the country to justify more than the minimum. In fact there ought not to be as many as eight."

I asked him if he was thinking of today or tomorrow. He asked me what I meant. I said, "How many people had this nation gained in fourteen years, since 1900?" He said he did not know. I said, "It has gained 23,000,000, a nation of Americans, with a producing power greater than that of any nation in South America." I asked him how much the banking resources had increased. He said he did not have it in mind. I said, "Nine and one-half billions in fourteen years." And I added, "In my judgment they will double in the next fifteen years." And my estimate was about eight billions too low.

There are businesses in this country today whose scale of operation is governmental in its magnitude. There are two businesses I have in mind whose gross expenditures last year exceeded those of the federal government before the Great War, whose income was greater than that of the ordinary receipts of the federal government before 1914.

If business is done on this scale today, what will it become during the lifetime of young men and women now receiving their training for business in colleges, universi-

ties and technical schools? Opinions of some scientists to the contrary notwithstanding, there is no reason why the world and the nation may not expand as much in the next fifty years as they have in the last fifty. If this picture of what has happened in the lives of those of us who look back upon the past fifty years may be repeated during the lives of young people now receiving their educations, it is clear that these men and women of tomorrow must use their imaginations, must try to form some sort of conception of what they are up against if they aspire to business leadership.

Change in Business Organization

And they must remember that it is not merely the size of business, the scale of things, that has changed, but the form of organization also.

Broadly speaking, there were no corporations in this country until after the Civil War. They began to be formed in the seventies, a few before that; and then they floundered around, trying to find their way, experimenting under the direction of able promoters, and some exploiters. They got so big that people actually called them "trusts" and the public got hysterical about them, and began to pass laws to control them. The flood of anti-trust legislation came pretty well to an end by 1890. It was needed, because there were abuses which had to be corrected, although some men did not see that they had to be corrected, and some of them resented the laws which were passed to help to correct abuses.

Today, most of those men will tell you that they were active in doing things then, as a matter of course, which today they would regard as highly unethical; and as they look back on those days they do not quite so strongly resent the efforts of the public to subdue them, to bring them out of the jungle into the useful and the good.

As late as 1890, individual enterprises and partner-

ships produced $5,000,000,000 worth of products; the corporations only $7,750,000,000.

In 1919, individuals and partnerships produced only $3,500,000,000; the corporations produced at least $60,000,000,000 of commodities.

Today, 90 per cent of the products of the country are produced, and the services, such as those rendered by the banks and public utilities, are rendered by enterprises under corporate form; and that is not all. The form of ownership has changed.

Wider Distribution of Ownership

In the earlier period, much of the resentment of the public was due to the fact that these growing enterprises were owned by families, or by a few individuals. Even very recently, there was an outcry against insurance companies, because they were controlled each by a very few men.

Now, what is the situation today? Take even the retail trades. Ten of the large retail houses, which one would expect to be closely owned and held, have at least 41,000 stockholders; two packing houses, 126,000; the Pennsylvania Railroad, 140,000; the Steel Corporation, about 146,000; the Class 1 railroads, approximately 750,000; the American Telephone and Telegraph Company, and its Associated Companies, 400,000 common stockholders and 165,000 preferred stockholders; the public utilities—the other public utilities—approximately 2,000,000 owners; the insurance companies, about 98,000,000 owners, because those who hold the policies are the owners, since they are mutualized.

This is a vast revolution, and a thing only at its beginning in business. More and more, these businesses are inviting the public to own them, and the public is coming more and more to own them.

A very interesting thing is that these big enterprises, which some had thought might lessen the opportunity of the laborer, the small man, to get on in the world, are

the very things which have given him the opportunity to become a capitalist, because he can become an owner through the purchase of these corporate securities.

Planning for the Future

Business has become very much more stable. Fortunes are no longer, or at least not so frequently, made by single strokes of fortune. The accumulation of wealth has become a matter of careful planning, of precision, of a thorough grasp of relations; and, at the same time, of the most intimate, minute planning as to details.

Businesses now make their plans not merely for one year or for two years or for the next five years; but, in no very small measure, with the necessity of checking and rechecking, of course, for ten years and twenty years, and more.

The Bell System could not either arrange to secure its materials in time, or its equipment in time, or make intelligent plans for its financing, if it did not have programs more or less satisfactorily arranged reaching not only a year ahead, with reasonable exactness, but five years ahead, and ten years ahead; and in some cases more.

Planning is more and more becoming a characteristic of these expanded businesses. The character of management is tending to change. It is becoming a trusteeship for the public, as well as for the stockholders. There has developed a very definite sense of trusteeship. There is not any intelligent manager of a business now, of any big business, who is not as keenly sensitive (and he need be) to intelligent public opinion, and as responsive to its reactions, as the more intelligent of the public officials. He is coming to see that he must cooperate with the public; that he must cooperate with his government; that he must be frank with it; that he must render a service to the public, the greatest of service at the lowest possible cost.

A number of big enterprises have a singular disposition

not to desire large, abnormal returns on their investment, or abnormal profits. After securing a normal return on the investment, to keep the financial structure sound, to keep the business going, then they want to share whatever addition comes through invention, through improvement, with the public.

If it is a business affecting the public, and there is no business which is not in reality also affected by the public interest, the tendency in considering problems of this kind will more and more lie in that direction.

The World's Most Fluid Nation

And the method of transacting business is changing; in this country perhaps more than in any other it is changing. This is the most fluid nation in the world today. They call us provincial! There are more Americans in Paris than Frenchmen who had traveled out of France in years; and there is more contact among people of this country—more mental contact—than there is in any other two continents in the world. Waves of emotion can sweep over this country more quickly than any other. You can tell a story in New York City at seven o'clock this evening, and come west by aeroplane, and find that by nine o'clock next day they are telling it in San Francisco.

Twenty-two billions of messages fly through space even on the telephone; and a routine business transaction affected by telephone in five minutes has involved $30,000,000.

This is a picture of business in its larger aspects—the thing called modern business with which the young man of today is preparing to relate himself.

The Value of College Training

Now what about the young man? Does he need a college training? Business men used to say not. Most of them still say not. They used to say that he did not need it even to go into law; that he needed little or no law

training. They said the same thing with regard to medicine. Most people say the same thing today with regard to business.

It seems to me that the young man about to enter business needs a college training, and very much more. The average college graduate is not a very mature person. He has pursued his studies in years of comparative immaturity, and has had to whet his faculties mostly on elementary matter.

If he can take two years when he has got over his lack of maturity, and devote his faculties to things which will give him a broader outlook and foundation on which he may build, he is likely to go much farther and be more satisfactory to himself and to the world, than if he enters business immediately after graduation.

There is room for the young man with a broad foundation. There are only about seventy-five thousand people who take college degrees in this country annually; and yet we have 117,000,000 people. There are only 18,000 graduate students in America. And not all of these graduates who enter the field of modern business prove satisfactory. Frequently the fellows with whom they rub elbows, and who have never had their opportunity, are much better.

Education cannot make a man. The public seems to think that it can do even more than that. Sometimes one cannot help feeling that schools in America, or many of them, simply testify to the indestructibility of the intellect. At any rate we expect too much of them. The truth is that educating men is the best way we know to help them to get on and up in the world. The fact that we are spending more for education in America than all the rest of the world is spending has something to do with what we are. It explains in part why we are so prosperous and have such high standards of living.

By education you can help a man a little; you can help him develop himself; you can help him expand what is in him; but you cannot put anything in him; you can

only develop what you find there. And no two men are alike. You cannot change them. Each has his good points and his weak points, his particular capacities; and the best thing you can do is to try to evolve him along the line of his capacities.

The Limitations of Education

One hears a great deal of discussion about training executives. I do not believe that you can give a man executive ability. You cannot give some men artistic ability. You cannot give some men research capacity. We are wasting a vast sum of money in this country today—it is one of the educational crimes—in putting facilities at the disposal of men for research purposes who might better be plowing. If you find a man who has the research capacity, give him everything you can put at his disposal.

You cannot teach a man to be a good lawyer. You cannot teach a man to be a good doctor. You can help a man with the requisite natural endowment, if you give him the right orientation and let him react on the proper facts long enough, to make a good lawyer or doctor of himself. And you can make telephone executives only in the same way.

We have been in the business of trying to make lawyers and doctors for a very long time. It is true that only lately have we the right sort of facilities for training doctors; for a little longer time, for training lawyers. It is only recently that we have had many medical schools worthy of the name; and yet, with all the facilities we have, we have very few good doctors, and very few good lawyers.

The Danger of Mechanized Education

One danger in our business education is that it may become too mechanized. To place it on the same footing as law, or medicine, or engineering, we may be too eager

to professionalize it, and unduly to emphasize the technique and machinery of business.

In our eagerness to professionalize business and to attempt to develop a program of subject-matter comparable to that of a law or a medical school, we may fail to see to it that the student who aspires to become a business leader has the requisite background and grounding in the fundamentals. For my own part, I think it desirable that the young man who aspires to be a business leader shall take time to get the requisite foundation, to secure an authoritative grasp of the elements of economics, banking, finance, history, and government.

I confess I should hesitate to send my son, after he finished college, to a business school, realizing how little background he gets in his undergraduate course, if I knew that his nose was to be stuck in the technique of business, in which he will subsequently spend fifty years of his life.

He ought to be taught something about accounting. It would be a good thing for a boy before he enters business to know the theory of banking and enough about the practice of banking to find his way around in a bank, to be able to draw a check, at least; enough about credit and investments to know their meaning; something about their terminology; something about the organization of business, its financial structure, the marks of a good financial structure, and of sound financing; not so much about the specific problems he may have to solve later as about the method of approach to such things, and the standards and tests to apply.

Then, above all, I should want to be sure that the man who is going to manage business, who aspires to business leadership, has an authoritative grasp of economic principles, which he could not get in his undergraduate course, and is not likely to pick up in business.

The young man ought to know something of the evolution of industry. Any intelligent business leader should know the leading marks and characteristics of the

industrial experiences of mankind, in Greece and Rome, and England, and France, in Europe since the beginning of the Middle Ages; and he ought thoroughly to know the industrial evolution of his own country.

I should go farther and say that he cannot possibly know too much history. Very many business men, business leaders, suffer greatly from a lack of knowledge of history and economics.

History may seem to be very remote; and yet a man untrained in history, in any business of any consequence, may find that his thinking is hampered, simply because he does not know the ordinary experiences of the world. I could give many instances which have come to my observation, both in the business of the government and the business of the world, of the mistakes business leaders have made in their thinking, and in planning, because they knew neither economics nor history. That applies not only to industry but to agriculture. Apparently every generation has to learn its lesson anew, and is led by leaders knowing no history to repeat the mistakes of preceding generations.

In our relations with educational institutions and with the young men who receive their training in them, and in passing judgment upon the adequacy of this training when employing graduates, we of the Bell System may well keep in mind that the task of business education is not so much that of teaching business as that of training men to handle business. When considering the qualifications of men who have studied in a graduate school of business, we should expect, of course, that they will have been taught its technical aspects as far as possible. But we should see to it that these men, above all things, shall have had a thorough grounding in fundamentals. This will be more important to them in the long run as factors in the world of modern business; as possible leaders in a great business enterprise and a great public service.

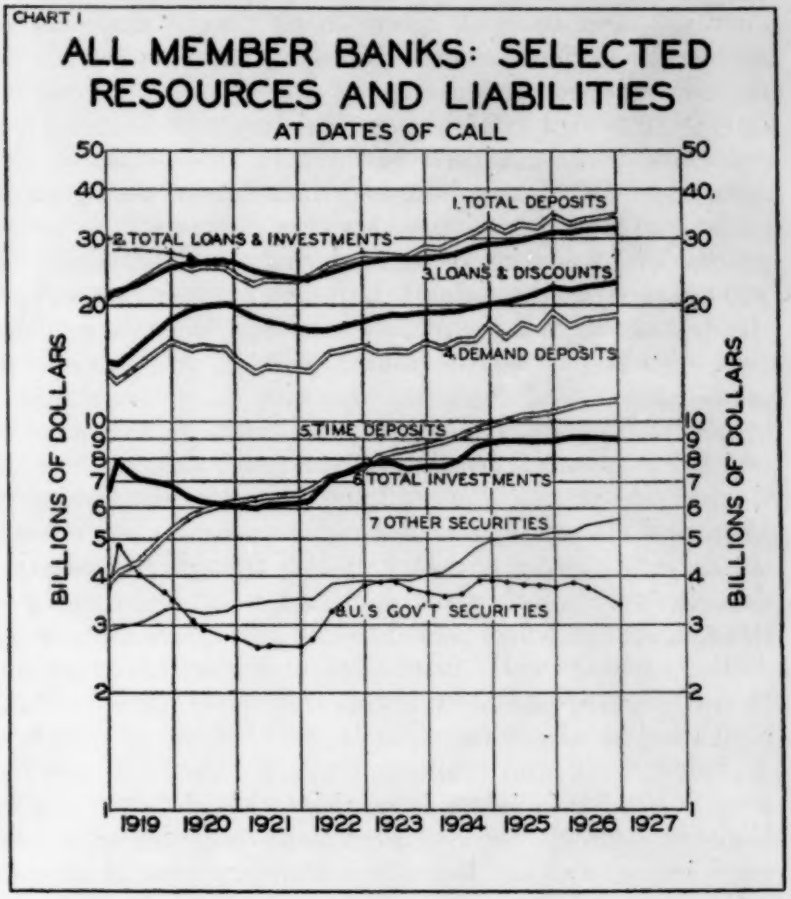
"Member Bank" Statistics

An article on "Federal Reserve System Statistics," in the July, 1926, issue of this QUARTERLY, was devoted primarily to a discussion and interpretation of statistics relating to the twelve federal reserve banks which, together with the Federal Reserve Board at Washington, constitute the nucleus of the federal reserve system. The present paper will consider some of the statistics that are available covering the operations of the commercial banks of the country which are stockholders of federal reserve banks and thereby member banks of the federal reserve system. On December 31, 1926, there were 9,260 of these member banks. While constituting only about a third by number of all the incorporated banks in this country, they represent fully two-thirds of the total commercial banking strength of the United States. Their total resources on December 31, 1926, were $42,029,644,000, of which $25,669,069,000 represented the resources of the 7,900-odd national banks in continental United States on that date, all of which are required by law to be members of the federal reserve system. The remaining 40% of the resources belonged to some 1,350 banks, organized under state laws, which have joined the system.

The Comptroller of the Currency is directed by Congress to call for reports of condition of national banks at least three times a year. The Federal Reserve Board calls for similar condition reports from all member banks on most of the occasions of the Comptroller's call. Chart 1 gives, on a logarithmic scale, some of the important items of assets and liabilities of all the member banks on each reporting date of the years 1919 to 1926, inclusive. In no two years are the reporting dates the same, and therefore the chart is of limited value for a year-to-year comparison, but it is of interest from the point of view of long-time growth and long swings. The logarithmic scale permits comparisons of rates of growth

rather than absolute growth. Liabilities appear as hollow lines; assets as solid lines.

Most of the curves show a peak in 1919 or 1920; the one exception being that of time deposits, which has a steady rise throughout the period. In every case but one,



the 1919 or 1920 peak has been passed in more recent years, as a result of the factor of growth more than overcoming the effects on banking resources of the crisis and liquidation of 1920–21. The exception is that of the holdings of United States Government securities, which

have never since been as high as they were just before the Victory Loan was floated in the spring of 1919.

Curves 1 and 2, those of total deposits (the outstanding liabilities, the sum of curves 4 and 5) and total loans and investments (the outstanding assets, the sum of curves 3 and 6) show generally a pretty close correspondence of movement. The fact that the curve for deposits dipped under that of loans and investments during 1920 and 1921 is a typical boom and crisis phenomenon, bearing witness to the need of business at the same time for greater loan accommodations and greater cash, and bearing witness also to the relatively slow process of liquidation of loans during the depression. It will be seen that throughout the course of these two curves, the deposit curve is the more sensitively fluctuating of the two. Ever since the beginning of 1922, in spite of the great activity of business, deposits have been maintained well above loans and investments; a relationship which has no small bearing on the relative credit ease of the last five years. Curves 3 and 4 showing, respectively, loans and discounts, and demand deposits, have contours similar to those of curves 1 and 2, though the demand deposit curve is below the curve for loans and discounts throughout the whole period. The great bulk of demand deposits arises from the prior creation of loans to customers. In the long run especially is this true, both for individual banks and for a banking system as a whole. A loan-demand deposit ratio greater than one is characteristic at least for commercial banks in the large cities, though in the case of town or country banks investments may be relatively more important than loans, and the loan-demand deposit ratio may not always exceed unity. It is clear that a commercial bank, one of whose principal aims must always be to remain liquid, must seek to have at least its demand deposit liabilities fully offset by such liquid assets as good short-term loans and cash (including balances with other banks).

Investments and Time Deposits

Curves 5 and 6 represent two other items which tend to move in general concord,—the asset of total investments and the liability of time deposits. Here the liability normally is created first, and the particular form the asset takes is at the discretion of the bank instead of at the customer's will. Time deposits are so-called because their withdrawal is subject to notice, if the bank desires to require such notice, and hence the cash left with the bank for such deposits can properly be put into investments of somewhat longer average duration than the loans and discounts which offset the demand deposits. The extraordinary rapidity of growth in time deposits over the last eight years is clearly reflected by the steepness of curve 5. The peak in curve 6 in the early part of 1919 and the wide spread between curves 5 and 6 at that time reflect the banks' participation in the tremendous volume of war financing, resulting in holdings of U. S. Government securities of greater amount than would ordinarily have been held, and made possible by the member banks' borrowing for that purpose at federal reserve banks.

Finally, curves 7 and 8 divide the investments into two classes,—United States Government securities and all others. They show that there has been an almost uninterrupted growth in the holdings of "other securities," while the banks' investment *swings* have been primarily in the holdings of federal securities.

More will be said about most of these items in what follows; but it will be said in connection with a different group of statistics, which are issued weekly instead of at irregular intervals three or four times a year.

Reporting Member Banks

In its desire to keep currently informed of banking conditions throughout the country, in order to perform its proper functions and form its policies as intelligently as possible, the Federal Reserve Board began a number

of years ago to receive weekly reports from some hundreds of member banks in the principal cities of the country. The banks which render these weekly figures are known as the "reporting member banks." Though less than 700 in number, these banks, including as they do virtually all the larger city banks, have about two-thirds of the resources of all the member banks of the federal reserve system. Their statistics therefore represent a large sample, and what is more important, fluctuate much more sensitively, and therefore give a much better key to short-time and significant changes in banking conditions than would the figures for the other 8,500 member banks. The Federal Reserve Board publishes weekly statistics covering over a dozen important items in the balance sheet of these reporting member banks, giving the totals for the group as a whole and subdivided by federal reserve districts. At one time more than 800 banks were reporting and therefore the statistics do not represent entirely homogeneous series, but the lack of homogeneity is more apparent than real, since much of the shrinkage in the number of reporting banks has come about through consolidations.

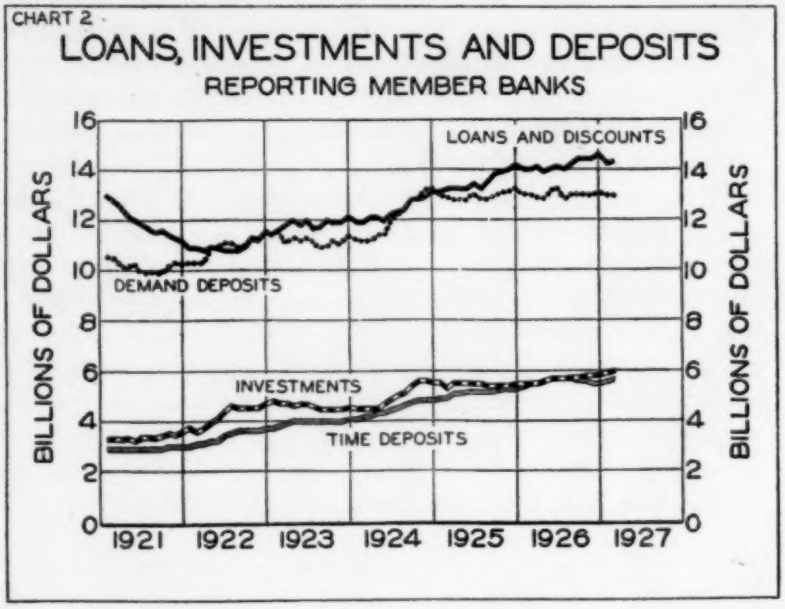
Loans and discounts: (A)	
Secured by U. S. Gov't obligations (A)	$144,347,000
Secured by stocks and bonds (A)	5,546,123,000
All other loans and discounts (A)	8,606,238,000
Total loans and discounts (A)	$14,296,708,000
Investments: (A)	
U. S. Government securities (A)	2,376,755,000
Other bonds, stocks and securities (A)	3,285,467,000
Total investments (A)	$5,662,222,000
Total loans and investments (A)	19,958,930,000
Reserve balances with F. R. Banks (A)	1,641,457,000
Cash in vault (A)	256,117,000
Net demand deposits (L)	12,974,056,000
Time deposits (L)	6,015,832,000
Government deposits (L)	103,469,000
Due from banks (A)	1,246,862,000
Due to banks (L)	3,375,938,000
Bills payable and rediscounts with F. R. Banks (L):	
Secured by U. S. Gov't obligations (L)	182,784,000
All other (L)	96,041,000
Total borrowings from F. R. Banks (L)	$278,825,000

Herewith is given the weekly condition statement of the 676 "reporting member banks in leading cities" at the close of business Wednesday, March 2, 1927. It will be noted that the statement, unlike the corresponding weekly statement for the twelve reserve banks given in the article in the July, 1926, issue of this QUARTERLY, is not a complete balance sheet, but comprises only certain selected items from among the assets and the liabilities of the member banks reporting. To emphasize this fact, the letters (A) and (L) have been added to designate "assets" and "liabilities," respectively.

Passing reference may be made to three types of assets and to three types of liabilities, shown on the foregoing statement, though not on Chart 1. The assets are: reserve balances with federal reserve banks, cash in vault, and due from banks. These three assets represent the primary reserves of the banks against demands for funds on the part of customers. Only the reserves with the federal reserve banks count as part of the so-called "legal reserve," that is, the reserve which the Federal Reserve Act prescribes must be kept by member banks against deposits. The cash is simply till money, and it will be seen represents only 1¼% of all deposits. Amounts due from banks represent the funds held in correspondent banks for any one of a number of purposes. More will be said later about the reserves with federal reserve banks as well as about the outstanding asset item not yet mentioned, namely, total loans and investments.

The three liabilities referred to in the foregoing paragraph are those to the United States Treasury (Government deposits), those to other banking institutions (due to banks), and those to the federal reserve banks (total borrowings from federal reserve banks). Government deposits require no comment whatever. The size of the item due to banks, $3,376,000,000, as against only $1,247,000,000 due from banks, is a reflection of the fact that we are dealing with statistics of city banks. Country banks find it convenient and necessary to carry balances

with city institutions, while the reverse is true to only a very minor extent, and hence the excess of the "due from banks" item over the "due to banks" item. The amount borrowed from federal reserve banks on the date shown by the statement, $279,000,000, was only about a sixth of the reserve balances with the reserve banks, indicating that the greater part of the reserve balances were due to actual deposits by the member banks with the reserve banks, and not to advances from the latter. This should be normally the case, and indeed not since 1921 have borrowings from federal reserve banks been in excess of balances at those banks.



Loans and Demand Deposits

Chart 2 reproduces for the reporting member banks four of the curves shown on Chart 1 for all member banks. These figures appear weekly, but the chart shows only the monthly fluctuations, the figures for the reporting dates nearest the end of each month being shown. Not

only the fact that monthly figures are shown, but also the fact that reporting member banks' statistics are more sensitive than those of non-reporting banks, enable this chart to bring out certain relationships more clearly than does Chart 1. (Charts for reporting member banks are shown only from 1921 or 1922 on, because prior figures are not available for all the series.) Distinct differences may be noted between the curve for loans and discounts and for demand deposits, respectively. Following the liquidation of 1920–21, demand deposits began to pick up in the final quarter of 1921, whereas the liquidation of loans continued into the third quarter of 1922; not until then did the effects of the business recovery which had been going on for a year more than counterbalance, through increasing lending operations, the disastrous effects of the 1920 crisis. The ratio of loans to deposits is characteristically high in a time of active business, not only because loans increase but because deposits tend to decrease. In the event of a crisis, the ratio typically remains high for some time, because many loans are "frozen," while business disasters, increasing unemployment, and other factors tend to keep drawing down the deposits.

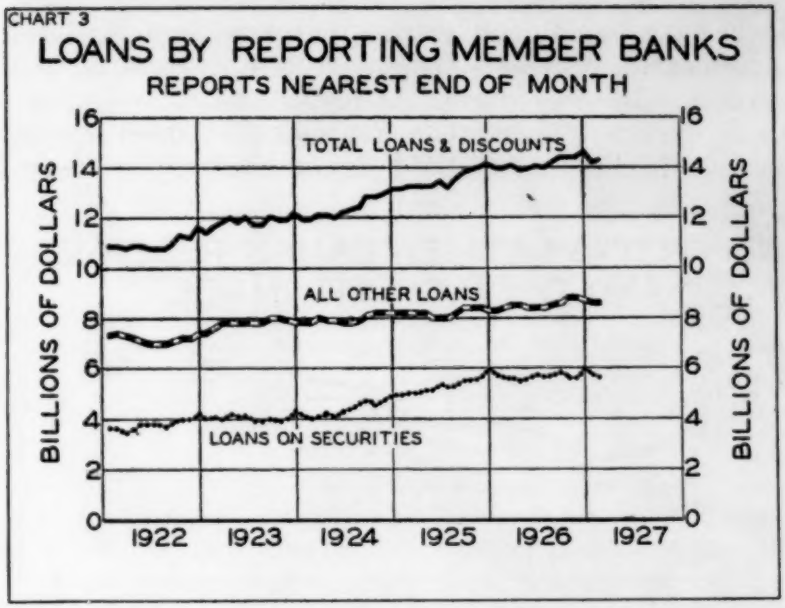
Business activity reached a peak in the early part of 1923 and deposits stopped increasing, as they characteristically do at such a time, while loans continued to increase. The recession that followed was not, however, an aftermath of a crisis but was an entirely orderly affair. Deposits merely moved horizontally for about a year; then the combination of large gold imports, substantial security purchases by the federal reserve banks, and some minor factors caused the very notable increase in demand deposits observable in the last three quarters of 1924, an increase which amounted to about two billion dollars. Again loans lagged in the upward march, but having once more started upward, they continued to increase with little interruption, whereas demand deposits have gone along on a plateau for more than two years

with almost no changes other than seasonal; though at the same time, an increase of about a billion dollars has occurred in time deposits. In the last quarter of 1926 the loan-demand deposit ratio was at the highest figure since the last quarter of 1921, though nothing even suggesting credit stringency obtained.

Deposits and Reserve Balances

It is worth while at this juncture, and partly parenthetically, to call attention to the similarity of configuration of the curves for demand deposits and investments. It was suggested some pages back that the growth in time deposits has made possible the great increase in investments. In the long run, these two factors would tend to move together. Over shorter periods, however, investment holdings may be much more definitely affected by fluctuations in demand deposits, since these investments represent assets acquired and disposed of entirely at the banks' will, and therefore readily adjusted to charges in demand-deposit liabilities. We have already seen that the swings in the investments have largely taken the form of purchases and sales of United States Government securities. The existence of billions of these securities has profoundly affected commercial bank investment policy ever since our entry into the war caused the securities to be issued by the billions. Before the war, the call loan on Wall Street was the instrument principally relied on first to take up and let out slack in a bank's funds. Today United States Government securities are used to a considerable extent, though not to the exclusion of the call loan. Both Government security investments and loans on Wall Street represent assets whose retention or disposal involves no moral responsibility toward a customer as do the majority of "all other loans." Chart 3 shows the distribution of all loans and discounts between loans on securities and all other loans, and shows that the run-up in loans on securities which began at about the same time as the sharp

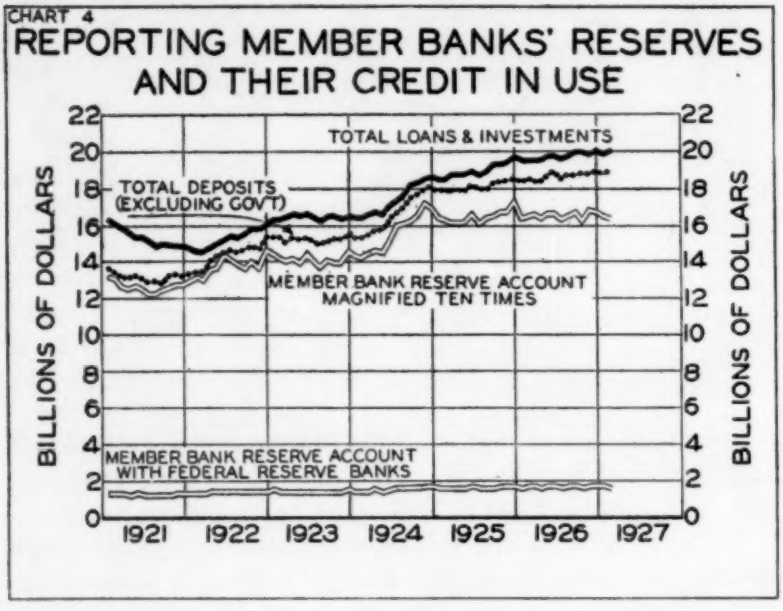
rise in demand deposits and also the rise in investments, in the first part of 1924, continued all the way through 1925 instead of ceasing at the end of 1924. Chart 3 shows also that whereas at the beginning of 1922 loans



on securities amounted to only about one-third of all loans, at the beginning of 1927 they accounted for more than 40% of the total.

Turning now to the relationship of time deposits and demand deposits, it is important to bear in mind that whereas member banks must carry on balance with the federal reserve banks an amount equal to 13%, or 10%, or 7% of their demand deposits (depending on whether the member banks are located in central reserve cities, reserve cities or elsewhere), they need keep reserve balances of only 3% against time deposits. This provision has naturally acted as an urge to increasing the proportion of time deposits, and has doubtless been the principal reason why the time deposit curve on Chart 1 is the steepest of all the curves on the chart. The growing

proportion of time deposits has reduced the average ratio of required reserve balances against all deposits. The significance of this is evident from Chart 4, on which a comparison is made between total deposits and member bank reserve account, the latter magnified ten times. It has been said with justice that minimum legal requirements on reserve balances have become actual maxima. In other words, the banks tend to keep practically no excess reserve balances with the federal reserve banks. In 1921, as Chart 4 shows, total deposits were



but little more than ten times the reserve balances; that is, the average reserve balance required and kept was something less than 10% of total deposits. From the middle of 1922 on, the spread between the two curves becomes increasingly pronounced, and early in 1927 the ratio of reserve balances to total deposits was well under 9%. For this, the disproportionate growth of time deposits is almost wholly responsible, although, to be sure, a disproportionate increase in the deposits of non-

reserve-city banks would have a similar effect. It is clear from Chart 4 that the banks have at their disposal several hundred million dollars or so more to put into investments or to lend as they please than they would have if their reserve balances bore the same ratio to their deposits, as in 1921. This has been a factor, even though a minor one, in increasing the supply of bank credit available, and hence in increasing credit ease.

Supply of and Demand for Credit

In the six and a half years ending with the close of 1926, this country imported on balance more than $1,500,000,000 in gold. This has been unquestionably the outstanding factor, in comparison with which all others are of lesser importance, in increasing the power of the commercial banks of the country to extend credit. The factor of gold imports and its relation to federal reserve credit was noted in the article of last July. The gold has come into the possession of the member banks and has by them been deposited in the federal reserve banks, where it has served to build up reserve balances or to reduce borrowings. Had borrowings not been reduced, member banks could have greatly increased their own deposit liabilities against their increased reserve balances at the federal reserve banks, which would have meant that a far greater volume of credit would be outstanding than is at present. (What this would have done to either interest rates or prices is a matter for speculation into which we cannot enter here.) Meanwhile hand-to-mouth buying has kept down the commercial demand for bank credit; and declining commodity prices work to the same end. The high reserve ratios of the federal reserve banks, on the one hand, and the low proportion of member bank borrowings at reserve banks to member bank reserve balances at the reserve banks give two of the statistical keys to current credit ease.

Naturally, with the supply of available bank credit increasing and the commercial demand not proportionately

increasing, a considerable volume of bank credit has gone into the securities market in the form of loans on securities and purchases of investments, as well as into bank loans on real estate. A reflection of this is found in the annual report of the Federal Reserve Board for 1926, in which the Board comments on the declining ratio of the banks' holdings of paper eligible for rediscount to the banks' total loans and investments. According to the Board, the ratio fell from 24.2% in 1920 to 18.2% in 1926. Since, however, total loans and investments of all member banks stood at the end of 1926 at more than $30,000,000,000, while their borrowings from reserve banks at the same date were only about $700,000,000, it is clear that for the member banks as a whole (whether or not for individual institutions) a large margin still exists. It seems tolerably clear that unwritten laws have been far more potent than any written laws in avoiding inflation and overextension of credit in this country.

Several types of member bank statistics have not been dealt with in this article. One is the weekly release of loans by reporting member banks of New York City to brokers and dealers, secured by stocks and bonds. If space permitted, it would be interesting to study this series, but the remarks on the lowest curve on Chart 3 must suffice in this field. Another group of statistics is that of debits to individual accounts in member banks of principal cities, which were devised to improve on the available statistics of bank clearings. These debits figures, however, constitute an index of general business conditions rather than of banking conditions, and therefore are not within the scope of this article.

Conclusion

Like the article on federal reserve system statistics, the present article has largely avoided questions of banking policy, and has confined itself generally to description and interpretation of certain banking statistics, in the

light of economic conditions and business fluctuations. Statistics on operations of commercial banks were available before the war, whereas the federal reserve system did not exist before the war. In a sense, therefore, member bank statistics are not as novel in their character as federal reserve system statistics. Yet it must be recognized that banking operations are of such different character now from what they were before the war that pre-war interpretations of banking statistics have limited validity for the present situation. The existence of the federal reserve system, the enormous holdings of gold in this country, the great influence of the large volume of United States Government securities; the changed modes of business as reflected in hand-to-mouth buying, increased installment buying, and generally increased efficiency; the much greater attention paid to current statistics in the guidance of business and banking policy,—all these things and others mark a new era with which pre-war conditions are not comparable.

With the passage of time, implications of the movements in the various banking factors, as reflected in the statistics, will become increasingly clear. At the same time evolution will constantly be taking place along many lines all the way from the relationships of the volumes of the different types of bank credit to the importance of New York in the banking structure. This article has aimed only to indicate some of the fundamental present factors in the picture for the country as a whole, and, like the article of last July, has had to eschew the interesting study of regional banking statistics.

J. HERBERT LEIGHTON.

EDITOR'S NOTE:—Mr. Leighton is of the staff of the Chief Statistician of the American Telephone and Telegraph Company.

Lines of Communication in the Great War

TEN years ago this April, America entered the World War. Immediately after our entry into the war many of the employees of the Bell System entered the military or naval service. During the previous year, in 1916, a considerable number of the Bell family received their initiation in a military campaign during the period of the Mexican border service. The Signal Corps and other branches of the National Guard had in their membership many employees of the Bell System. This Mexican border campaign brought forcibly to our minds the need of preparedness. The World War had been going on with increased violence since 1914. Up until that time and, even with such a war as an example, our country was not prepared and no major effort was being made to bring preparedness about in a National way.

Much was, however, being done among the various industries and included in this category was the organization within the Bell System of twelve battalions of Signal Corps troops. In these battalions there were 2,508 officers and men. Later on there were several other organizations made up of Bell System personnel including such organizations as the Research and Inspection Section of the Signal Corps which was eventually located in Paris, two Radio Companies organized by the Western Electric Company and many special details and casuals sent over from time to time during the war.

Upon our entry into the World War the regular army Signal Corps consisted of 55 officers and 1,570 men. During the War this corps was expanded to 2,712 officers and 53,277 men. It will be seen from these figures that, the Bell System's 12 battalions together with their other organizations comprised a considerable portion of the Signal Corps personnel.

Many of the early conferences held between members

of the A. T. & T. Company, Western Electric Company, Associated Bell Companies and the Signal Corps (and in some instances with representatives of the Allied Governments attending) were held in the office of Brigadier General John J. Carty (then Major), Signal Corps Reserve, where the activities centered.

In the latter part of July, 1917, the first two Bell battalions were ready to sail for France. Theodore N. Vail, then President of the American Telephone and Telegraph Company, visited them at Camp Vail, N. J. and was overcome with emotion for several minutes as he started to address them. Major Carty at the same review reminded them that "never before has more been expected of men than is expected of you. The name of the Bell System extends throughout the world. General Pershing's signal officer recently wrote a letter in which he says that the French Signal Corps await with intense interest the arrival of our battalions to show them the wonderful development of American telephony."

Overseas

The activities of the United States Signal Corps in France during the World War were many and varied and an adequate description of all of them would fill many pages. This article, deals with but a single phase of the Signal Corps activities, namely, the establishment and operation of the backbone lines of communication for the American Expeditionary Forces, as an interesting historical record at this time.

There was built up in France during the war a telephone and telegraph system for the use of the American Expeditionary Forces which was unique in many ways. Incidentally, it was probably the largest telephone and telegraph system ever built for purely military purposes.

In the early conferences plans were made for a definite initial telephone and telegraph plant to be installed in the area which was then known as the "Lines of Communication" in the A. E. F. The original plan consisted of a

400-mile pole line connecting a base port in France with some point on the Western front which was at that time unknown. In addition to this plans were made for 265 miles of branch lines. The estimate of the amount of material and equipment required completely to outfit these lines and the offices which were to be located along them was worked out in great detail. After this study had been made, with considerable haste, but at the same time very carefully, requisitions were then prepared for all of the necessary units of equipment and line material which would be required to construct them completely. Shortly after Colonel Edgar Russel sailed for France, in May, 1917, these requisitions were placed in the United States for all of the material required. The only item which was not eventually filled in this country was the item of poles which required such a great tonnage and which it was presumed could be obtained in some manner abroad.

The initial difficulties will be better understood when it is realized that pre-war plans of the Signal Corps contemplated defensive warfare on the North American continent where a highly developed commercial telephone service would be available and the Corps' chief task would be the extension of field lines. The United States at that time had 14 telephones for each 100 inhabitants while France had only 1½ for the same unit of population. The French Government facilities were already over-loaded by their own requirements and the requirements of the Allied Armies already in France. The French Government was very generous in their allocation of facilities for use of the American Army wherever they could be spared, but these were entirely inadequate for the size of the military communication system which was to be built up in France.

In conferences, held as early as May, 1917, in the United States, a great deal of study was given to the proper types of telephone and telegraph systems to be built abroad by the Signal Corps. At that early date the

use of telephone repeaters was decided upon even though this type of apparatus required an expert personnel to install and maintain them. Telephone repeaters were chosen in lieu of loading and stringing larger gauge circuits, such as the 165 mil copper circuits used in this country. This decision made a tremendous saving in tonnage required for transportation of the material abroad since no circuits larger than 104 mils in diameter were installed by the Americans during the war. In addition to the tonnage required for the additional weight of the larger sized wire, a great saving was also made in the weight of loading coils which would have been necessary had they been chosen instead of the telephone repeating apparatus.

Another important decision made at this early date, was to employ multiplex printing telegraphs as the backbone of the telegraph system. It was realized that by the use of this type of apparatus that the maximum amount of telegraph traffic could be transmitted with the minimum number of line wires. Had a more simple type of telegraph system been decided upon, it would have required ultimately a great deal more equipment and supplies to provide for the same message handling capacity. Looking back upon the results obtained during the war, it is realized now more than ever the wisdom of the decisions made at these early conferences. Everything could not be figured out in advance with such meager information at hand. In total, however, practically all of the plans made were eventually consummated in the field.

Conditions in France

The conditions existing upon arrival of the first Signal troops in France in June, 1917, were very disappointing. They found themselves in a strange country with unfamiliar equipment in use and inadequate supplies of their own types of equipment to use. In France, as in practically all the other countries of the world

except the United States, the open circuit type of telegraph system was in vogue. For their international circuits and also for their long circuits in France the Baudot printing telegraph system was employed which was different from any printing telegraph system at that time employed in the United States and considerably different from the type of printing telegraph being transported to France from this country.

In America the closed circuit type of telegraph system is employed almost exclusively. One of the first essentials of the closed circuit system is the use of telegraph relays and it so happens that in the system employed abroad practically no relays were used. The few which were used were used in connection with the printing telegraph system and were considerably different from the type required for use of Morse operated circuits, such as was planned. As stated before, apparatus and equipment was already being manufactured in the United States but due to the difficulties of transportation during the war, there was great delay in transporting this material abroad. Consequently, it was months before any of the newly developed equipment arrived there.

In the meantime, it taxed the ingenuity and resourcefulness of the Signal Corps troops to the utmost to provide the necessary and essential communication channels which were urgently needed. The first circuits used were those provided by the French and, since no American equipment was available, it was necessary to use French equipment which was also borrowed from them. These circuits were so different from those used in the United States that the troops were unfamiliar with their operation and they could not be extended into the flexible system which is possible by the use of closed circuit telegraph. Consequently, there were great difficulties encountered in operating them. The problem concerning the American Signal Corps was quite different from that of either France or England. France had her own Governmental circuits to use as a basic

network. The English, on the other hand, although operating in a foreign country, were such a short distance from home that supplies could be readily obtained on short notice. Also their system used at home was much more nearly like that employed in France and consequently there was not as much difficulty or confusion in operating it. The geographical area also covered by British Armies in France was relatively small compared to the area covered by the American Army including the services of supply.

At the end of October, 1917, the Signal Corps was operating offices at Le Havre, Paris, Nevers, Gondrecourt, Chaumont and Tours. The lines connecting these offices were French telegraph circuits. At that period the daily average telegrams handled was 425 and the Long Distance telephone calls 200.

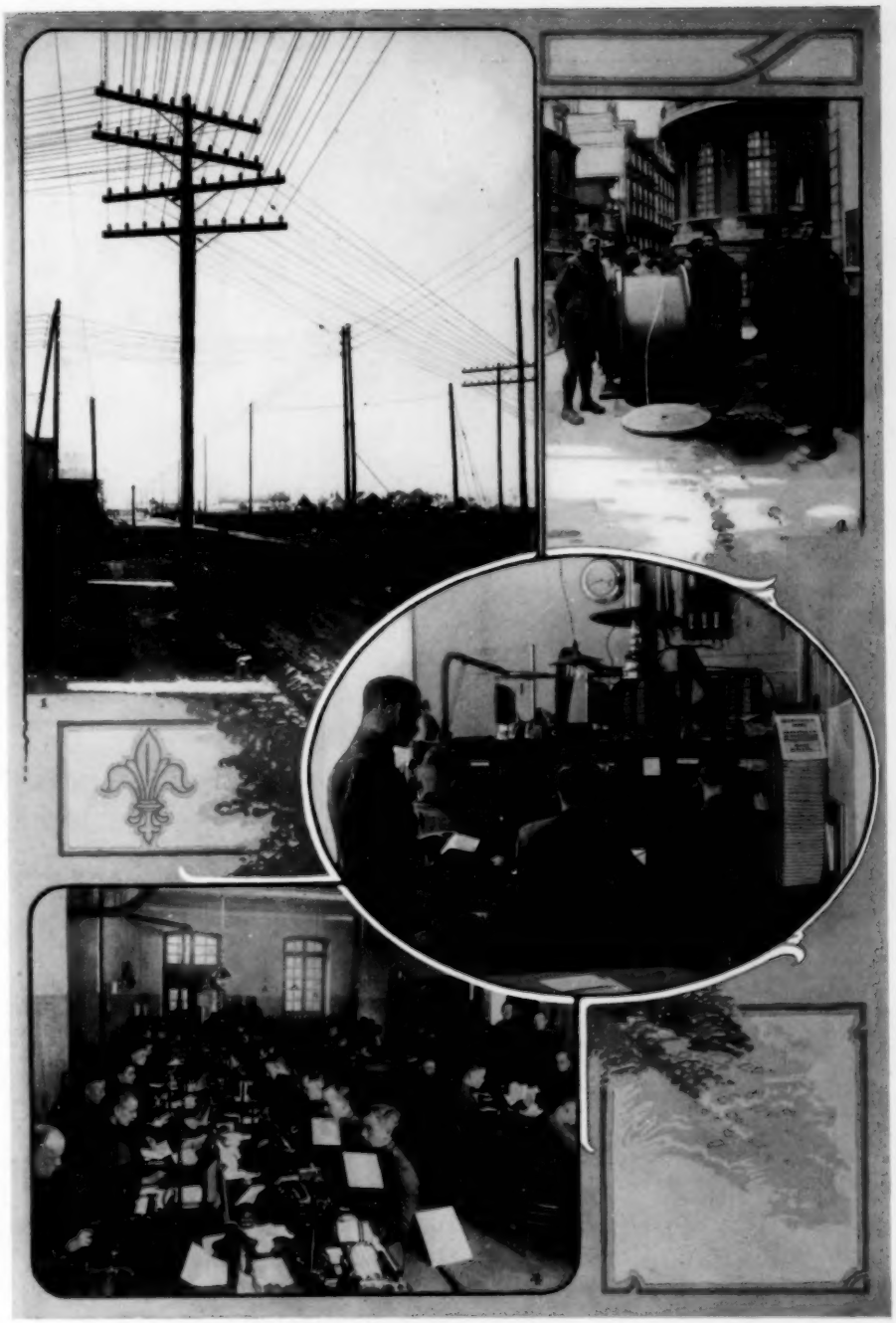
Headquarters Moves to Tours

In January, 1918, the headquarters of the lines of communication was moved from Paris, where it had been located prior to that time, to Tours. It was then necessary to provide circuits radiating from Tours connecting other important American headquarters. A line was already under construction by the American telegraph battalions from Chaumont to Tours via Dijon. In order to facilitate the establishment of these first circuits only one phantom group was strung, although later on the additional six wires were added making a total of ten, the entire distance and in some shorter sections considerably more wires. Prior to the completion of the first four wires on this line circuits were obtained from the French and telegraph circuits established from Chaumont to Tours via Paris. These circuits were operated with improvised equipment assembled by the Signal Corps. On this first American built line a telephone and telegraph repeating station was established at Autun which was approximately the half way point between Chaumont and Tours.

These American lines were very different from the French ones made up of "H" fixtures with steel crossarms connecting the two poles and extending beyond both of them and with pins which were made of steel and held an insulator both above and below the crossarm. The writer recollects particularly a testing station along one of their routes where the line was terminated in each direction on an "H" fixture and each "H" fixture pole had a pole used as a push brace making a total of eight poles being used where, in the ordinary type of American construction one pole would be used with double crossarms. The French phantom circuits on these lines were arranged on four pins representing a square and instead of being transposed as American lines are, the circuits were rotated as they extended from pole to pole. Both telegraph and telephone circuits were routed over the same pole line but practically no circuits were used jointly for telephone and telegraph simultaneously. In fact the two departments, one operating the telephone and the other the telegraph in the French *Postes et Telegraphes* were more independently separated from one another than our Bell System is from the commercial telegraph systems in the United States. Consequently, it was with great difficulty that telephone facilities were sometimes obtained for telegraph use.

Extensive Line Building Program

The line from Chaumont to Tours was the start of a line building program which continued throughout our period of activity during the war and for a short period after the armistice and extended over a considerable portion of France. The Signal Corps during the war built 1,724 miles of permanent pole line and strung 20,708 miles of wire. In addition to this considerable wire was strung on French pole lines. 1,984 miles of wire were strung on these lines. This made a total of 22,692 miles of wire strung by the Signal Corps as a permanent type of construction. They also operated



WAR COMMUNICATIONS IN FRANCE "A LA AMERICAINE"

1: American junction pole with the familiar cross arms. 2: Laying American telephone cable in a Paris sewer. 3: Signal Corps telegraph office at Nevers, France. 4: Telegraph operating room at Tours, probably the largest military telegraph office ever assembled.

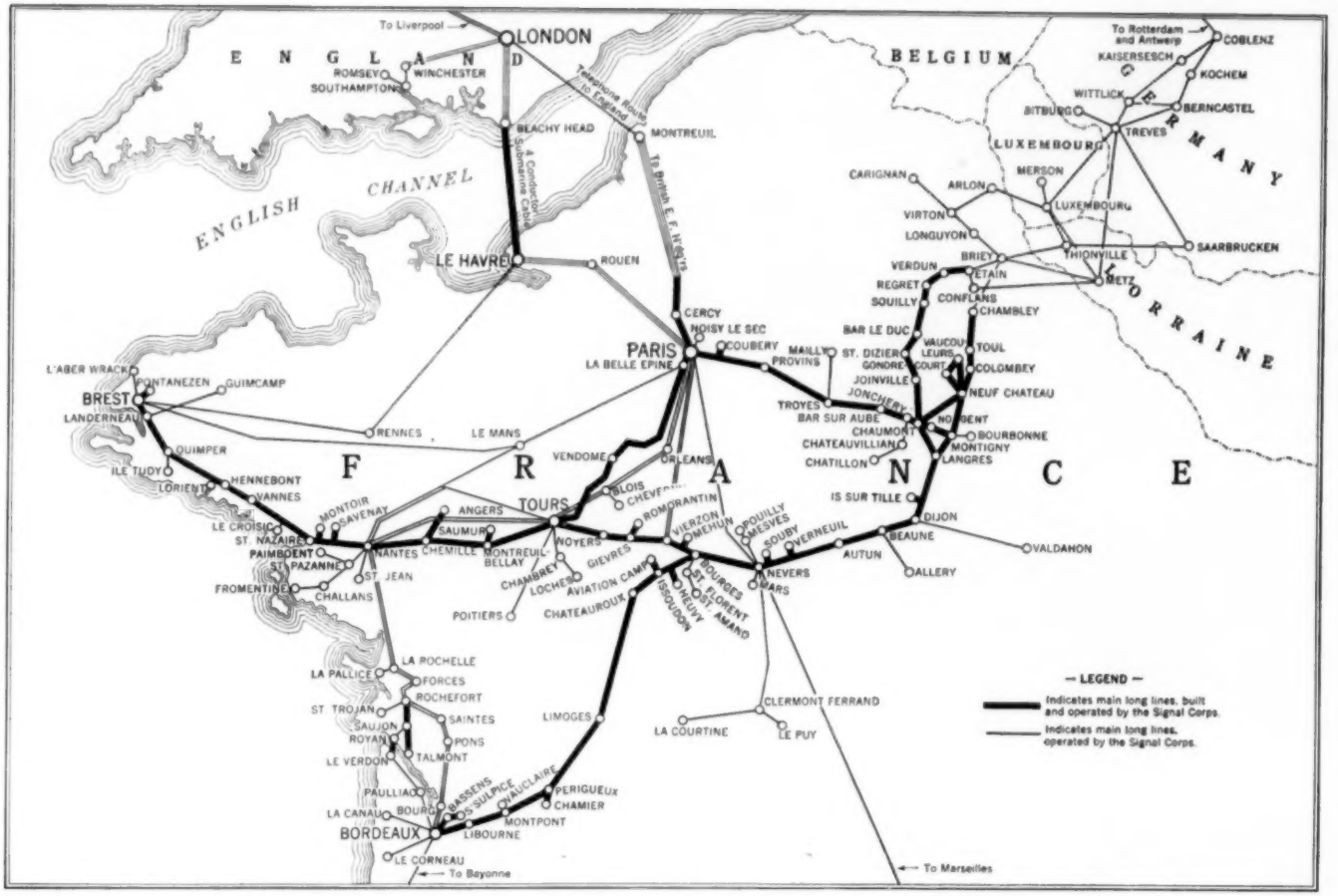


Chart of "backbone" routes of facilities built overseas by the U. S. Signal Corps.

and maintained 12,333 miles of wire which was loaned by the French and operated 15,252 miles of wire which was maintained by the French. The main pole line routes constructed by the Signal Corps were from Chaumont to Tours, from Tours to Brest, from Bordeaux to Bourges, from Tours to Paris, from Paris to Chaumont, from Chaumont to Neufchauteau, from Neufchauteau to Langres, from Neufchauteau to Chambley via Toul, Chaumont to Souilly via St. Dizier. From Souilly toward the front several other small portions of line were built and also a line was built for the Navy's use from Rochefort to Talmont with a cable crossing at the Garonne River.

Practically all of this construction of pole line and wire stringing was done between January 1, 1918 and the Armistice date. This will give some idea of the magnitude of the work accomplished during such a short period of time. This part of the work of the Signal Corps was done principally by men formerly in the Bell service and it was primarily their Bell service training which permitted them to accomplish so much work in such a short period of time. When the lines were finished, they were for all practical purposes typical Bell telephone lines, with the exception of the poles which were undersized due to the fact that it was impossible, at that time, to obtain poles of the proper size abroad. There was nothing built in France by the American Army which was so typically American as these telephone lines with *crossarms*, the mere sight of which recalled our familiar lines at home.

There were many things in constructing these lines in France that made their accomplishment extremely difficult. In addition to being in a strange country and working under adverse conditions and frequently under the worst kind of rainy weather, the enemy also interfered frequently with our plans. A case of this kind which comes to mind is the proposed pole line which was to have been built from Joinville, North of

Chaumont to Compiegne, but which was not built due to the fact that prior to the date that the line was to be started practically the whole area between these two points was in the enemy's hands. Fortunately this happened before the material was delivered and the material was then later on used to construct a line from Chaumont to Paris and around the South and West of Paris, connecting with the French telephone circuits from Paris to Le Havre so that in case Paris should have been taken by the enemy it would not have interfered with the through circuits. In addition to this a complete telephone and telegraph repeater station was constructed at La Belle Epine, southwest of Paris. In other instances in building the line toward the front from Chaumont, frequently the signal battalions doing the work were under enemy fire and most always working under the most extreme difficulty.

Urgent Call for Telephones

The Army as a whole, and especially the Signal Corps, little realized when they went to France the universal use of the telephone which would be made. This use of the telephone service was evidently a result of the almost universal use of the service made in the United States and the Army soon learned how impossible it was to carry on business as at home, without the aid of the telephone. Consequently, there was demand for telephone service far in excess of anything ever anticipated.

When a patron in France subscribed to telephone service the Government there furnished the wire connection to the residence or place of business and it was then necessary for the patron to purchase a telephone locally from a store somewhat in the manner we here at home purchase a radio set. Consequently there was no uniformity as to the type of sets used and with a miscellaneous sort of equipment of this kind it was impossible to get instruments which were uniformly of equal effi-

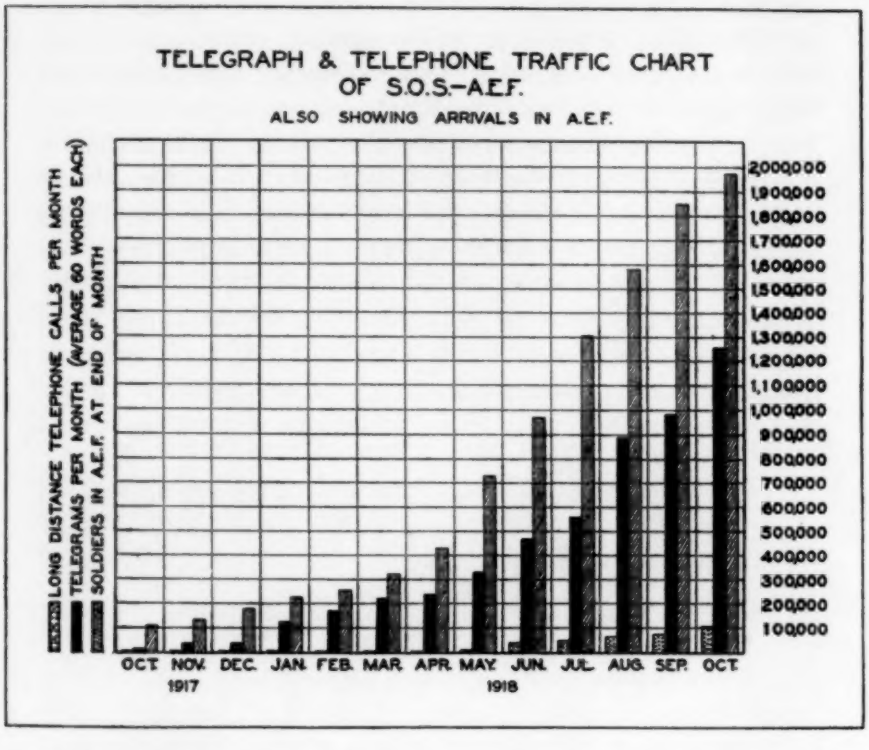
ciency, as are the Bell instruments. This feature alone practically eliminated the use of such telephones. George Ade once remarked, when speaking of these telephones, that any peculiar thing hanging on the wall of a French residence is liable to be the telephone.

When service first started an attempt was made to assign such French soldiers to operate the telephone service as could speak both French and English. Such service was not satisfactory, however, and then French telephone girls who could speak English were employed and this service also was far from being the kind of service which the Americans were used to. It was realized that if American service was to be furnished it would be necessary to obtain American operators and as a result of this units of American female operators were organized and sent to France to operate the offices in the area of the S.O.S. and the Zone of Advance. A few of them were also used in the Zone of the Armies at the various headquarters such as the first Army headquarters. Prior to the Armistice, 213 of these American women operators were sent to France.

In the early stages telephone switchboards were also obtained wherever we could get them but always these miscellaneous types of equipment exemplified the great advantages which exist in the Bell System of standardization of types. As soon as possible a Western Electric No. 1-D telephone switchboard was standardized for the larger offices. This was another result of the early conferences held in the United States where standards were picked as far as possible to fit into the conditions which it was anticipated would exist abroad. The cord shelves and the jack panels were each of a separate unit in this type of board so that either the cord shelf or the jack panel could be changed from time to time as conditions required rearrangement of the office with the least labor and in the shortest possible time. These boards were installed as common battery switchboards.

Telephone Repeaters an Important Item

As stated before, telephone repeaters had an important place in the circuit layout of the A. E. F. telephone circuits. In some cases these repeaters were installed as through intermediate repeaters and in other cases connected with switching cords and used as cord circuit



repeaters for extending the circuits to other circuits which had the proper electrical characteristics. These repeaters make it possible to use a smaller gauge wire or conversely to talk for greater distances over a wire of the same gauge. Telephone repeaters rendered a particularly valuable service just after the Armistice. During this period it was possible to talk from Brest to Treves and also from Tours to Antwerp and Rotterdam via

Coblenz. The accomplishments of the Signal Corps spread to the other Armies of the Allies and as a result during the Peace Conference the Americans installed at Turin, Italy, a telephone repeater on the direct Rome-Paris Circuit.

All of the wire strung by the Americans in France was 104 mils in diameter. The French circuits were usually 2 millimeters (about 79 mils) in diameter. In some cases, however, 4 millimeter French circuits were furnished. Our 104 mil circuits used in connection with telephone repeaters, proved more efficient for transmitting the telephone conversation than even the large sized 4 millimeter circuits of the French.

There were 14,854 telephone stations connected to 396 central offices. During the period of the war it was estimated that over 25 million local calls and 870,000 long distance calls were made over this American system.

Telegraph System Developed

Although there were over 100,000 long distance calls made during the month of October, 1918, over the Signal Corps system, the number of telegraph messages amounted to over ten times this figure. The telegraph went through several stages before the highly efficient system was finally evolved which carried this great volume of traffic. At first attempts were made to use French instruments on French lines, but this was not satisfactory due to the different type of telegraph systems used abroad and at home. Next, the French instruments were modified to try and make them more nearly agree with our types of circuits. They were still not satisfactory, although they operated better then they did as first used. Later on small supplies of American instruments arrived and were put in service as rapidly as possible.

Before these American instruments arrived in France, however, duplex sets were constructed using French electrical instruments which were designed for other purposes but the sets operated very efficiently consider-

ing the way in which they were assembled. The open circuit French system was not satisfactory primarily due to the fact that when the operator sends on the circuit his own sending is not heard as is the case on the American system and consequently it was very difficult for our operators to send without hearing their own signals. Furthermore, if the signals cannot be heard it is impossible to use automatic sending machines such as "Vibroplexes," and many of our most expert operators used these automatic machines. Consequently, the operators were not efficient using the French type of circuit. It was furthermore very difficult to connect intermediate offices to the circuits on their system which limited the circuit layout when French instruments were used.

The method of operation was changed starting about December 1, 1917, as rapidly as possible from an open to a closed circuit and finally from the French instruments to American instruments. During this early period the system was being rapidly extended as fast as possible, only limited by the instruments available and the circuits which could be obtained or built. A special duplex set was designed by the Engineers of the Western Electric Company and standardized for use by the A. E. F., but delivery of these duplexes was delayed considerably due to difficulties in getting shipments forwarded abroad.

The Western Electric Co's. Paris Branch, *Le Materiel Telephonique*, gave another instance of the helpful results obtained through the agency of the Bell System by making available to us a certain amount of cargo space in ships leaving for France, assigned to them but not being fully used. An order for some equipment, including 100 telegraph sets complete, placed through the Paris Branch arrived in France on January 25, 1918, much ahead of the requisition placed earlier in the United States. The regular requisitions generally required six months for delivery. It is not hard to imagine the difficulty of estimating requirements so far in advance with the expeditionary forces overseas rapidly growing to two million

men and when in the latter part of 1918 it was anticipated that within six more months over four million men would be abroad.

The French telegraph officials used to smile when we would tell them that we were going to install Morse duplexes. They would say that they don't use Morse on their fast circuits but use printers. When finally Morse duplexes were installed and manned with two expert telegraph operators at each end equipped with typewriters for receiving, these same officials looked on in amazement while the American operators copied messages with a speed and accuracy which was unknown to them. The Frenchmen, some of whom could read the Continental telegraph, would listen carefully to the sounder but seldom could they even read a letter to say nothing of copying the message as the American operator was doing.

General Russel used to delight in telling of how some high French officials were dumbfounded to see one of the operators in the Paris central, in the presence of his chief, pause in his rapid receiving to light and enjoy a cigarette without losing any of the message.

Printing Telegraphs Used

Although it was decided, even as far back as May, 1917, to use multiplex printing telegraphs in France the first set, due to delays in shipment, was not placed in service over there until April 28, 1918.

It was soon realized that it would not always be possible to get necessary facilities for the operation of the quadruple duplex multiplex in the A. E. F. and consequently it was decided over there to change the original plan so that double duplexes and later on triple duplexes could be used. These double duplexes and triple duplexes were suitable to operate in connection with composited telegraph circuits which were the standard type used. The final result was that by making the change as stated no circuits were strung in France exclusively for the use

of telegraph with the few exceptions where circuits were strung along the railroad for the Director General of Transportation. These circuits were only strung in this manner then because no telephone circuits were needed. It is believed that this is the first case on record where a combination had been established for regular service, either in the United States or abroad of using double duplex or triple duplex, multiplex printers on composited telephone circuits. This arrangement was, however, accomplished and a very satisfactory service furnished.

In discussing a paper on the multiplex given at a meeting of the American Institute of Electrical Engineers in New York during 1920, Brigadier General Edgar Russel (deceased) testified to its value for the A. E. F.:

General Russel's Remarks on Printing Telegraphs

"I can speak of the multiplex telegraph with positive affection. It was such a good friend to us at the time of our severe need, and it helped us out in such a marked way, when difficulties seemed to be mounting beyond the possibility of our meeting them.

"At the time when the telegraph business in France was growing beyond all bounds, and the mounting traffic curve seemed as if it were going to fall over backwards, these instruments we succeeded in getting over in the midst of vast tonnage and personnel difficulties, rescued us from a very difficult situation. After these instruments were put in operation, our very greatest difficulty, the lack of Morse operators, became much less acute. When the multiplex was established between our headquarters at Tours and Paris and Chaumont, traffic difficulties immediately gave way and our concern about insufficient telegraph service between those main points practically vanished.

"The possibility of putting, as we did by composite

devices on the telephone lines, a six-way multiplex transmission was, I believe, first demonstrated in France. I do not understand that it has been the practice in this country to composite for six-way transmission. The system succeeded wonderfully. When the American cable was laid across the English Channel, we operated it with this six-way system between our headquarters in Chaumont, France, and London.

"Our multiplex telegraph system in France was a standing wonder to our French friends.

"I think that the speedy application of the American multiplex to our needs in France was the outstanding feature of our telegraphic accomplishments. The way in which we arrived at our decision to adopt the multiplex may be of interest. Before I started to France with General Pershing on May 28, 1917, I had only a few days in which to decide. But I had been in consultation with General Squier at Washington, who had assured me he was going to support us with every possible assistance that could be secured in this country, and when I came to New York and saw Colonel Carty, and some of his associates in the great companies controlling the supply of personnel and material, I realized that with such support as that, I would be justified in recommending that we go ahead with the installation of the modern multiplex and the modern telephone repeater systems.

"As you understand, we were far from our base, in a strange country, and where we could not get spare parts or the facilities for repair. Besides, there were tonnage difficulties and difficulties of manufacture in this country owing to the conflicting activities of war. But I now feel as I look back on that critical time, when we had only a day or two to decide, what a serious mistake we would have made if we had assumed the conditions of war would not permit us to avail ourselves of this wonderful modern invention. In the midst of the enormously growing demands upon us, we could say to officers 'Gentlemen, bring us all the telegrams you want. You

do not need to limit your telegraphic correspondence in any degree.'

"Those who have been over in France know of the delays we had in getting mail—in fact, the difficulties in the mail service seemed insuperable but by the free use of the telegraph service which this instrument gave us, we were enabled to transmit promptly this vast volume of messages, which the mail service was inadequate to handle expeditiously."

Capacity of Circuits

The multiplexed circuits in the American Expeditionary Forces were operated at the speeds noted below:

Tours-Chaumont, triple duplex composited at
30 words p.m., 22 cycles, 180 r.p.m.
Tours-Chaumont, double duplex composited at
30 words p.m., 15 cycles, 180 r.p.m.
Tours-Paris, double duplex composited at
52 words p.m., 26 cycles, 312 r.p.m.
Tours-London, double duplex composited at
30 words p.m., 15 cycles, 180 r.p.m.
London-Paris, triple duplex simplexed at
36 words p.m., 43 cycles, 216 r.p.m.
Chaumont-London, triple duplex composited at
30 words p.m., 22 cycles, 180 r.p.m.

Note: All of these circuits being operated full duplex had a total capacity of 1,044 words per minute or 2,088 messages per hour, or a daily total capacity of 50,112 messages per day of 24 hours.

Further Activities

In addition to building lines, installing telephone and telegraph offices, operating these offices, etc., the Signal Corps was called upon to perform many other duties in connection with maintaining communication in an army of this large size. Books of instruction were

prepared, personal messages sent home for the soldiers, and telephone directories compiled. The telephone directory for the district of Paris issued in June, 1919, contained five local exchanges and a list of 326 different towns, all operated and reached over the Signal Corps system.

The telegraph service developed into a letter service sent by telegraph due to the fact that all communications sent via the regular army postoffices were slow in reaching their destination. This fact diverted practically all important communications, no matter what their length, to the telegraph circuits. The Signal Corps was always proud of the fact that at no time did it fail to prepare in advance sufficient circuits to handle without delay, all of the telegrams filed. Mobile telegraph offices were equipped so that they could be readily moved from place to place as needed. In some of these offices telegraph repeaters and duplexes were installed in addition to the main line and local batteries and all of the other necessary requirements for a complete telegraph office.

Although the duplex sets designed for the Signal Corps in the United States and finally installed in the A. E. F. were very suitable with minor changes made in the field for that type of service, they were not suitable for the service near the Front, particularly because of their weight and of the high voltage required for their proper operation. Consequently, another duplex set was designed for use where only low battery voltages were available in offices which were intermediate between the actual field lines at the Front and the permanent lines in the S.O.S. In almost every instance where a large telephone or telegraph office was installed and equipped by the Signal Corps, it was necessary to install also a complete power plant, as the local electric light service was so unreliable that it was unsafe to depend upon it for a source of power. A motor vehicle type of storage battery of 224 ampere hours capacity was usually installed, 24 volts for the telephone and 108 volts for the telegraph.

As a charging unit either a 30 volt or a 160 volt Delco Gasoline Electric set was used. These sets and batteries were all installed in duplicate. From this it can be seen that the matter of installing a telephone or telegraph office or both at any point of considerable size was quite a difficult task. In addition to these difficulties, frequently the offices were installed in French barracks, built generations ago when they were considered forts in case of need as well as barracks. Often the walls between rooms in these buildings were at least four feet thick and of solid masonry. The writer clearly recollects one of these barracks at Limoges where the walls were eight feet thick, which it was claimed was at one time used as a headquarters by Napoleon.

Combined Telephone and Telegraph System

Up to this war it is believed that practically all field lines were installed as separate circuits for the telegraph and for the telephone. In this war, however, which was being carried on at such a tremendous scale, it was immediately seen that in order to conserve the supplies and equipment, it would be necessary to make the most economical use of all line circuits of any considerable length. Therefore, from the start a system was planned which would use jointly the same wires both for the telephone and for the telegraph, using the latest methods in vogue at that time in America. As this combination of services was expanded, some steps even in advance of those which were used at home, were put into use and gave very satisfactory results.

The standard arrangement of constructing wires between large centers was to string four wires and phantom them so that three telephone circuits would be obtained and from this combination four telegraph circuits were also obtained. Invariably where traffic was heavy, these telegraph circuits were duplexed, and in some cases, between large centers, such as Tours and Chaumont, Tours and Paris, Chaumont and London, Chaumont and

Paris, etc., multiplexed printing telegraph was added to the duplex. The duplexes provided two telegraph channels, while the first multiplexed circuits provided four channels. Eventually, some of these multiplexed circuits were changed to six-channel circuits or triple duplexes and as such gave very satisfactory service even over composited facilities. This arrangement meant that each telegraph wire could handle six messages simultaneously and the ultimate capacity of a four-wire group between two points was three telephone and twenty-four telegraph channels. This ultimate capacity was not actually used although between Tours and Chaumont the four wires were equipped with one triple-duplex multiplex, one double-duplex multiplex and two Morse duplexes and as such operated satisfactorily for a period of several months.

Since most of the seventeen cable channels across the Atlantic Ocean terminated in England, it was always necessary to maintain contact with London. This was the chief route of all messages between Washington and General Headquarters at Chaumont. For a long time communications between Chaumont and London were handled over a very poor circuit operated by the open circuit method between Chaumont and Le Havre via Paris and using one conductor in a submarine cable loaned by the British. This circuit could not be operated at high speed and worked poorly under the best conditions. In order to relieve this difficult situation, a four-conductor submarine telegraph cable was ordered by the American Government from a British cable manufacturing concern, and was eventually laid between Beachy Head in England to a point near Le Havre in France. This cable across the channel provided four telegraph circuits. All of the four conductors were eventually duplexed in order to operate each of them simultaneously in both directions and later on a multiplex printing telegraph was also added to three of the four conductors. In the final circuit layout, which was

during the period of the Peace Conference at Paris, from these four conductors eighteen telegraphic channels were obtained. Two conductors were operated triple duplex, one double duplex and the remaining one a Morse duplex for hand operation. The Morse circuit was used by the Navy Department. These combinations of telegraphic and telephonic circuits where they are operated simultaneously over the same wires, are cited because it is believed that they are unique in their connection with military circuits.

A French officer remarked early in 1918 that the American Army consisted of automobiles and experts. Regarding the technical experts who were in the Signal Corps from the big commercial concerns in the United States, such as the Bell System, General Pershing on February 19, 1919, issued and published to the American Expeditionary Forces the following statement:

General Pershing's Commendation

"Now that the active operations have ceased, I desire to congratulate the officers and men of the Signal Corps in France on their work, which stands out as one of the great accomplishments of the American Expeditionary Forces—the result of a happy combination of wise planning and bold execution with the splendid technical qualities of thousands of men from the great commercial telephone, telegraph and electrical enterprises of America. It is a striking example to the wisdom of placing thoroughly skilled technical men in the places where their experience and skill will count the most.

"Each Army Corps and Division has had its full quota of field signal battalions which in spite of serious losses in battle accomplished their work, and it is not too much to say that without their faithful and brilliant efforts and the communications which they installed, operated and maintained, the successes of our Armies would not have been achieved.

"While the able management of the directing personnel

is recognized, it is my desire that all members of the Signal Corps, who, regardless of long hours and trying conditions of service, have operated and maintained the lines, shall know that their loyalty, faithfulness and painstaking care has been known and appreciated. In the name of the American Expeditionary Forces I thank them one and all and send to them the appreciation of their comrades in arms and their Commander in Chief."

Among the soldiers' bodies that were returned to the United States for reburial were numbered 51 late employees of the Bell System. Their bodies were met at Hoboken with wreaths, inscriptions, and every last honor that the home organization could render. In addition, the Bell System provided in perpetuity for the annual decoration on Memorial Day of the graves of the 84 former employees who lie buried in the Military Cemeteries of France, Belgium and England. The total Bell System Service Flag comprised 20,900 stars.

FRANK HOMER FAY.

Economic Notes, First Quarter 1927

THE Federal Reserve Board made public in March its annual report for 1926. The Board addresses itself at some length to the questions of the use of federal reserve credit by member banks and the character of member bank credit outstanding. In an article on federal reserve system statistics in the July, 1926, issue of this QUARTERLY, the statement was made that "the tradition was quickly built up that banks should in normal times keep 'out of the federal reserve bank,' except to meet seasonal and other temporary needs, and the typical borrowing by most of the large banks is for very short periods such as a day or two." The Board indicates that much progress has been made in the last few years in reducing the number of continuously borrowing member banks and "the proportion which continuous borrowing constitutes of total borrowing," and states that except for certain circumstances, "funds of the federal reserve banks are primarily intended to be used in meeting the seasonal and temporary requirements of members and continuous borrowing by member banks as a general practice would not be consistent with the intent of the Federal Reserve Act." The Board comments at some length on the change in the character of member bank credit over the last four or five years. This change has been in the direction of increased volumes and proportions of real estate loans, increased investments, and a larger volume of loans secured by stocks and bonds, and a decreased proportion of strictly "commercial" loans. The percentage of national banks' loans and investments which is eligible for rediscount at federal reserve banks declined from 24.2% in June, 1920, to 18.2% in June, 1926.

In a section of the report devoted to gold imports and dollar balances, the Board comments on the dollar balances in New York "built up not only by foreign industrial corporations and commercial banks but also

by European and South American central banks, which in many instances are authorized by law to keep a portion of their reserves in the form of foreign exchange in countries with stable currencies." "The central banking reserves of the United States . . . have thus become indirectly a part of the reserves against bank credit and currencies in other countries. The existence in America of these foreign balances consequently presents a condition in the banking situation to be taken into account in determining the federal reserve system's credit policy with a view to maintaining the country's banking system in a position to meet demands for gold from abroad without disturbing business and credit conditions in this country."

* * *

In view of some of the foregoing remarks by the Federal Reserve Board on member-bank loans, it is worth noting that the so-called McFadden Banking Bill, which was enacted into law in February, liberalized certain provisions of the Federal Reserve Act in regard to loans on real estate by national banks. The McFadden Act permits national banks in central reserve cities (New York and Chicago,) for the first time to make loans on real estate. It also permits all loans on real estate by national banks to run for as long as five years, whereas previously only loans on farm land might be made for a longer time than one year.

Among the other provisions of this highly important piece of legislation are the following:

1. The charters of the federal reserve banks, which were to expire in 1933, are made of indeterminate length. This will do much to keep the System from being subjected to political pressure. The charters of national banks are also made indeterminate in duration. This will help national banks in some states to secure certain trust business which they cannot now accept.

2. National banks are permitted to "establish and

operate new branches" (not mere offices) within city limits "if such establishment and operation are at the time permitted to state banks by the law of the state in question," subject only to provisions as to the number of branches in small cities. State banks are specifically permitted to retain existing branches in conformity with state law, whether out of city limits or not, but not to acquire new branches beyond city limits if membership in the federal reserve system is desired. Already a California institution, the outstanding example in the whole country of state-wide branch banking, has become a national bank.

3. National banks are permitted under certain circumstances to declare stock dividends. They are also permitted for the first time to have shares of stock of a par value less than $100.

Other provisions of the Act increase the scope of business of individual national banks. Altogether the Act takes rank with one of our most important pieces of banking legislation. Whatever the disagreements as to the merits or demerits of the several provisions, there is no question that it strengthens both the federal reserve system and the national banking system,—the latter by increasing the attractiveness of membership and thus discouraging the tendency of banks to give up their national charters and convert into state-chartered institutions.

* * *

In its notable study, "Income in the United States," published about five years ago, the National Bureau of Economic Research calculated the dollar income of the people of the United States, annually, from 1909 through 1919. Later the Bureau added its computations for 1920 and 1921. No further computations or estimates have been forthcoming from the Bureau until this year, when estimates for the years 1922 to 1926, inclusive, were published. For 1926 the Bureau arrives at the stupendous figure of $89,682,000,000, as its preliminary esti-

mate, a figure which the Bureau says "may be as much as 10% in error," though it believes "the probabilities are that the error is not as great as that." The figure is distinctly higher than the general range of others' estimates, but it should be noted that the Bureau's definition of income is much more inclusive than most other definitions by statisticians working in this field, since it summates "(1) wages, salaries and pensions, (2) profits withdrawn from business, (3) dividends, interest and rent received by individuals, (4) the rental value of homes occupied by their owners, (5) interest upon the sums invested in household furnishings, clothing, and the like, and (6) the value of commodities which families produce for their own consumption."

The increase shown by the 1926 income over the income in the depression year of 1921 is 43%. Translated into 1913 dollars, it is 46%. The Bureau puts the 1926 income per capita at $770, and the 1926 income per person gainfully employed at $2,010. Each of these figures represents a gain of more than 130% over the calculated figure for 1913. Even when translated into 1913 dollars, a gain of about 37½% is indicated. In other words, the Bureau estimates that the real income of the people of this country is about three-eighths greater per person than it was in 1913.

It may be of interest to note in comparison with the foregoing, an estimate of German national income in "Das Deutsche Volkseinkommen," by Dr. Erich Rogowski, published last year. Dr. Rogowski estimated that the per capita income in Germany in 1925 was at most about 800 marks, or $200. Even allowing for lack of strict comparability, the contrast between this figure and the figure of $770 for the United States is striking enough. Dr. Rogowski's estimates pointed to a decline in real income per capita in Germany of about 20% from 1913 to 1925, as against the increase noted above for the United States.

* * *

In July, 1926, issue of this QUARTERLY, the fact was noted that "the month of May completed a period of six months, in each of which the visible balance of German foreign trade was 'favorable,' with a total for the period of over 600,000,000 marks." Certain special reasons for this were adduced and it was said that "it would be rash to conclude that the 'favorable' balance of trade will be permanent." Figures for German foreign trade for the whole year 1926 are now available. They show that commodity imports were valued at 9,951,000,000 marks, commodity exports at 9,818,000,000 marks, giving an "unfavorable" balance of trade for the year of 133,000,000 marks. In addition to this excess of imports of commodities was also an excess of imports of gold and silver, amounting to 579,000,000 marks.

The character of German foreign trade is rather clearly brought out by the statistics of imports and exports, by commodity groups. These statistics show that of the imports, 49% by value were raw and semi-finished goods, and 36% were foods and food products (including beverages); while of the exports, 71% were finished manufactures, the products of German industry, and 24% raw and semi-manufactured materials.

Germany's ability to purchase during 1926 imports to a value in excess of the value of her exports was assisted by borrowings in the United States, by governmental units and corporations, to the extent of about $300,000,000.

* * *

The Bureau of Navigation of the United States Department of Commerce has issued "Merchant Marine Statistics 1926." The report shows that the tendency which has been evident in the last half dozen years or so, for the percentage of American foreign trade carried by foreign vessels to increase, and that carried by American vessels to decrease toward pre-war levels, is continuing; though the proportions are still far different

from those of the generation before the World War. In the fiscal year 1926, 32.2% by value of all imports and exports were carried in American vessels, as compared with 42.7% in 1920, but as compared with 9.3% for the five fiscal years 1909 to 1913, inclusive. British vessels carried more than 35% by value of our foreign trade in the fiscal year 1926. Of the vessels entered and cleared at American ports in foreign trade, 38% of the tonnage was American in the fiscal year 1926, compared with 51% in 1920, and 24% for the years 1909 to 1913, inclusive.

The report gives a table showing the tonnage of oil burning ships in commercial trade throughout the world as of June 30, 1914, and June 30, 1926. There was an increase from 1,722,000 tons in 1914 to 20,827,000 tons in 1926. Oil burners now represent just about one-third of the tonnage of the world's merchant marine.

* * *

The United States Treasury has put through a debt-funding operation which represents the largest turnover of government obligations since the Victory Notes were paid off. The Treasury sought to get rid of the Second Liberty Converted 4¼s, outstanding in the amount of about $3,083,000,000, by announcing an issue of 3½% 5-year notes, callable on and after March 15, 1930, which were not to be sold, but would be issued solely in exchange for the 4¼s. The 4¼s do not mature until 1942, but are callable on November 15, 1927, or on any interest date thereafter. The Treasury does not now call 4¼s, but simply indicates that it *will* "call some or all of these bonds dependent upon conditions." In order to induce holders of the 4¼s to convert at this time, they will be paid interest up to May 15th, although surrendering their bonds on March 15th. On February 28th there were outstanding some $3,080,000,000 of the 4¼s. The following comments may be made on this transaction:

1. If conversion had been complete, it would have saved about $23,000,000 a year in interest after the first year.

2. Whatever the degree of success, it will perhaps give some indication of whether in 1928 the Treasury will be able to put through a similar operation with little or no cash turnover at the maturity of the 3rd Libertys, now outstanding to the amount of about $2,150,000,000.

3. Treasury notes being eligible for sinking fund purposes, the Treasury will during the years 1929 to 1932, inclusive, have a volume of notes outstanding which will be more than sufficient to exhaust the sinking funds for those years, without paying premiums, such as the Treasury has been paying for the 3rd Libertys. (Slight premiums might be paid in 1929, but from 1930 on the notes can be called at par.)

4. A Treasury official had previously indicated that he expected debt retirement to be sufficiently rapid so that the amount of debt payable between now and 1944 would probably be paid off by that date through the sinking fund, surpluses and payments of inter-ally debts. The Treasury therefore probably did not want to create another long-term issue maturing beyond 1944, and anything maturing this side of 1944 would not be a real long-term issue, or a real short-term one. The new notes will mature, further, before the first calling date of the huge 4th Liberty Loan, 1933 ($6,300,000,000), has arrived.

5. Given the factor of rapid debt retirement, the factor of low money rates will also in the near future probably continue to dictate a policy of short-maturity, low-coupon issues, purchaseable by the Treasury at any time at little or no premium. The recent rise in the long-term Treasury 4¼s to nearly 115 emphasizes the importance of this.

Abstracts of Recent Technical Papers from Bell System Sources

The Crystal Structure of Magnesium Platinocyanide Heptahydrate,[1] by Richard M. Bozorth and F. E. Haworth. Positions of the Mg and Pt atoms in crystals of $MgPt(CN)_4 \cdot 7H_2O$. These have been definitely determined by means of X-ray oscillating-crystal photographs and Laue photographs, using the theory of space-groups. Because the other atoms are too light in comparison with the metal atoms, especially Pt, their positions could not be determined. The Pt atoms are located at 0 0 0 and ½ ½ ½, the Mg atoms at 0 0 ½ and ½ ½ 0, in a tetragonal unit of structure 14.6AX14.6-AX3.13A. Two units of structure are shown in the figure. The peculiar optical properties are believed to be associated with the unusual arrangement of the heavier atoms in widely spaced rows parallel to the tetragonal axis. In these rows Mg atoms alternate with Pt atoms, and the distance between any two adjacent atom-centers is 1.57A. The shortest distance between rows, however, is 10.3A, 6.6 times the distance between atoms in the same row. The atomic radii of Mg and Pt as determined by Bragg from other crystal data do not agree with the observed distance between these atoms, the calculated value being 2.7A, the observed distance 1.57A. The observed distance, however, is consistent with that calculated by the method of Davey, who assumes that the radius of an ionized atom differs much from the radius of the same atom un-ionized, and that the radii of Cs+ and I− are substantially equal in crystals of CsI.

Photoelectric Emission as a Function of Composition in Sodium-Potassium Alloys,[2] by Herbert E. Ives and G. R. Stilwell. The entire series of alloys of sodium and potassium have been investigated with respect to the

[1] Physical Review, Feb., 1927, p. 223.

[2] The Physical Review, Feb., 1927, p. 252.

relative values of the photoelectric currents produced by light polarized with the electric vector in and at right angles to the plane of incidence. The pure metals when molten exhibit values below three for the ratio of the two emissions; the alloys show three maxima at compositions approximately 20, 50, and 90 atomic per cent. of sodium, with values from 10 to 30 for the ratio; the minima between show low values approximating those for the pure metals. The maxima and minima of the ratio of emissions are due to complicated variations in magnitude of the two emissions compared.

Submarine Insulation with Special Reference to the Use of Rubber,[3] by R. R. Williams and A. R. Kemp. (1) Soft vulcanized rubber, though not well adapted to some of the processes of manufacture of submarine cable, can be so made as to be mechanically and electrically suitable and to withstand the action of sea water in a manner comparable with that of gutta percha over a period of a few years. Whether such rubber will retain these characteristics for decades remains to be demonstrated, but it seems probable that it will.

(2) The principal factor to be controlled in producing this result is the amount of water absorbed by the rubber.

(3) Osmotic pressure of internal and external fluids is of prime importance in governing the in-flow of water into rubber and gutta percha.

(4) Lowered water absorption is achieved by removal of water-soluble matter from the rubber, the choice of an insoluble, non-reactive filler of suitable particle size and having a minimum of absorbed gases or other contamination on its surfaces.

(5) The electrical characteristics of rubber compounds and of gutta percha are clearly related to their water content but are not simple functions of the water content.

(6) It appears that the mode of distribution of water is also extremely important.

[3] Jr. of Franklin Inst., Jan., 1927, pp. 35-61.

(7) Most fillers for rubber compounds are not suitable for submarine insulation, either because of undesirable intrinsic electrical properties or because they are conducive to changes incident to water absorption. Hard rubber dust, silica and zinc oxide are the best fillers from these standpoints so far as known.

An Efficient Apparatus for Measuring the Diffusion of Gases and Vapors Through Membrances,[4] by Earle E. Schumacher and Lawrence Ferguson. An efficient diffusion measuring apparatus, embodying a mechanical clamp and a mercury seal, is described. This apparatus can be used for measuring the rate of diffusion of gases and vapors through materials such as rubber, waxes, leathers and certain types of paper.

Investigation of the Thermionic Properties of the Rare Earth Elements,[5] by Earle E. Schumacher and James E. Harris. Thermionic emission measurements over a range of temperatures were made on samples of pure Ce, La, Pr, Nd, Sa and the aluminum alloys of Yt, Eu, Ga, Tb, Dy, Ho, Er, Th, Yb and Lu. These measurements showed the rare earth elements, without exception, to be more active thermionically than the commonly occurring metals. At 1800°C. all of these metals gave emissions of more than 10^5 that of clean tungsten at the same temperature.

The Solidus Line in the Lead Antimony System,[6] by Earle E. Schumacher and Foster C. Nix. An investigation of the solidus line above the solid solution field for the lead antimony system was made by the quenching test procedure. Three points were determined between the melting point of pure lead, and the end of the eutectic horizontal. The position of the solidus line has been precisely fixed.

Production Control,[7] by C. G. Stoll. This paper

[4] J. Amer. Chem. Soc., Vol. 49, 427 (1927).
[5] J. Amer. Chem. Soc., Vol. 48, pp. 3108-3117 (1926).
[6] A. I. M. E. Pamphlet No. 1636-E, Feb. 19, 1927.
[7] Mechanical Engineering, Vol. 49, p. 201, 1927.

treats the subject of production control from the practical rather than the theoretical point of view. It is confined largely to a description of the generally accepted principals of production control as applied in the Manufacturing Department of the Western Electric Company. This plant employs approximately 30,000 people and produces annually over $150,000,000 worth of manufactured products. These products are comprised of some 13,000 kinds of apparatus containing over 110,000 different parts.

The paper discusses the organization of the factory, which is set up along functional lines, and also the extensive system of records and charts used to facilitate the work of the organization and to assist in production control.

The Significance of the Dielectric Constant of a Mixture,[8] by Homer H. Lowry. It is pointed out that in many cases it would be of great value to be able to calculate either the dielectric constant of a mixture of substances of known dielectric constants or, knowing the dielectric constants of a mixture of two components and that of one of the components, to calculate the dielectric constant of the other. A review of the literature, however, shows that this can be rarely accomplished. This is due mainly to the inadequacy of the theories of dielectrics, all of which are insufficiently developed to include the dielectric behavior of mixtures. Nevertheless, as is shown, many attempts have been made to develop formulae of theoretical significance for application to mixtures. Inspection of the derivation of these formulae shows that those with the best theoretical background are limited to such special cases that they are of practically no value. A brief review of these formulae is given together with a brief account of the results of experimental investigations on the dielectric behavior of mixtures. A rather extended bibliography is given.

[8] Jr. of the Franklin Institute, 203, 413-439, 1927.

The Effect of Moisture on the Electrical Properties of Insulating Waxes, Resins and Bitumens,[9] by J. A. Lee and Homer H. Lowry. The results of measurements of dielectric constant and effective conductivity at 1,000 cycles and resistivity are reported for 31 waxes, resins and bitumens, including not only naturally occurring products but also commercial dielectrics and mixtures. The measurements were made on the materials initially in a thoroughly dry condition, after six months immersion in a salt solution corresponding qualitatively to exposure to 98% relative humidity, and after having been redried. All the insulating materials studied absorbed water under the conditions of experiment. The absorption was least with the hydrocarbons and greatest with shellac and Bayberry wax. In general, the greatest increase in capacity and conductivity and the greatest decrease in resistivity were shown by the materials which absorbed the most water. The percentage change was much greater in the conductivity and resistivity than in the dielectric constant, as was to be expected.

The Mechanism of the Absorption of Water by Rubber,[10] by H. H. Lowry and G. T. Kohman. Data are reported which show the influence of the various factors which determine the amount of water absorbed by any given sample of rubber. From a consideration of the results obtained, it was concluded that, at a given temperature, the most important external factor determining the amount of water absorbed by a given sample of rubber is the vapor pressure of water with which it is in equilibrium. The data show further that the water soluble constituents within the rubber are responsible for most of the water absorbed at high humidities, that increasing the rigidity of a rubber compound decreases greatly the amount of water absorbed, and that aging increases the water absorption. It is pointed out that all the experimental facts are consistent with the view that the ab-

[9] Jr. of Industrial & Engineering Chem., 302-306, 1927.

[10] Jr. of Physical Chemistry *31*, 23-57, 1927.

sorption of water by rubber consists of two processes; the formation of a true solution of water in rubber, and the formation of solutions internal to the rubber of the water soluble constituents of the rubber which can be removed by washing.

Rapid Evaluation of Baked Japan Finishes,[11] by E. M. Honan and R. E. Waterman. The service life of a japan film baked on metal can be evaluated by determining the rate of decomposition of the film when it is placed in an 8.5 per cent phenol-water solution. The effect of the time and temperature of baking the film and the cleanness of the metal previous to applying the japan can also be evaluated. The 8.5 per cent phenol solution is a desirable testing solution because its composition is quite constant at ordinary room temperatures and is not changed by the evaporation of the water.

Developments in the Manufacture of Copper Wire,[12] by John R. Shea and Samuel McMullan. This paper describes a new copper rod and wire mill located at the Western Electric Company's Plant at Chicago. It includes a brief survey of the copper rolling and wire drawing art at the time the investigation was started; a summary of tests made in varying the practice in rod rolling and wire drawing; and an outline of the work done by the Western Electric Company Engineers in developing and designing new types of wire drawing machinery.

The rod mill is converting 225 pound wire bars into ¼" rod in fourteen instead of the usual eighteen passes. This is accomplished by making heavier reductions in the first four passes while the copper is hot. The new wire mill incorporates many novel features, and the wire drawing machines are more compact in design and of considerably higher speed than those in general use.

The design of the wire mill was undertaken following

[11] Ind. & Eng. Chem., Oct., 1926, Vol. 18, pp. 1066-1068.

[12] Bell System Technical Journal, April, 1927.

a comprehensive survey of wire drawing processes and equipment used in this country and abroad. Part of this survey consisted of a study of the manufacture of diamond dies, it having been found that dies suitable for high speed drawing required a differently shaped "approach," a better polish, and a shorter "land," than those which were available for low speed work. The economies in floor space and plant investment due to the use of more compact and higher speed machinery are outlined. Some of the outstanding features in plant arrangement which contribute to more efficient operation are discussed in the concluding pages.

A Study of the Regular Combination of Acoustic Elements, with Applications to Recurrent Acoustic Filters, Tapered Acoustic Filters, and Horns,[13] by W. P. Mason. The use of combinations of tubes to produce interference between sound waves and a suppression of certain frequenices originates with Herschel (1833), and was applied by Quincke to stop tones of definite pitch from reaching the ear. Following the development of electric filters, G. W. Stewart showed that combinations of tubes and resonators could be devised which would give transmission characteristics at low frequencies similar to electrical filters. The assumptions made by Stewart in the development of his theory are that no wave motion need be considered in the elements, and that the lengths of the elements employed are small compared to the wave-length of sound.

The present paper considers primarily regular combinations of acoustic elements, such as straight tubes, and shows that the equations for recurrent filters, tapered filters and horns can be obtained in this manner. The assumption of no wave motion in the elements, made by Stewart, is removed and also account is taken of the viscosity and heat conduction dissipation. The principal difference between acoustic and electric filters is that the former have an infinite number of bands.

[13] Bell System Technical Journal, April, 1927.

The effect of using filters between varying terminal impedances is also determined.

Studying next the combination of filters having the same propagation characteristics but in which the conducting tube areas increase in some regular manner, it is shown that a tapered filter results which has a transforming action in addition to its filtering properties. It is shown that if straight tubes are employed and the distance between successive changes in areas is made small we obtain the horn equations first developed by Webster. The general combinations of acoustic elements is then considered, and a proof of several theorems has been given.

Transatlantic Radio Telephony,[14] by Ralph Bown. Many of the technical and scientific features of Transatlantic Radio Telephony have been discussed individually in considerable detail in engineering papers. Furthermore, through the agency of the newspapers much general information has been published regarding the development of commercial telephone service between the old world and the new. Most of this published material either is sketchy in nature or is concentrated upon some detail of the system and it is difficult to gain from it a connected picture of how the final result was built up through several years of continued effort. This paper provides such a connected story.

Analyzer for Complex Electric Waves,[15] by A. G. Landeen and *An Analyzer for the Voice Frequency Range*,[16] by C. R. Moore and A. S. Curtis. The frequency analyzers described in these papers demonstrate in an unusual manner how a single fundamental principle may be employed to accomplish quite dissimilar results. The analyzers described in both these papers employ a resonating element of fixed frequency and translate the wave components under study to this frequency by heterodyning them with the output of variable frequency os-

[14] Bell System Technical Journal, April, 1927.

[15], [16] Bell System Technical Journal, April, 1927.

cillators. In the analyzer described in the first paper, the wave components under study are translated to a higher frequency while in that described in the second paper the translation is downward to a lower frequency. In view of these differences in design it is desirable to call particular attention to the reasons which have led to the working out of the two designs.

The analyzer discussed by Moore and Curtis has been so designed as to sweep through the voice frequency range to as high as 5,000 cycles by the manipulation of a single control. To accomplish this end, it was found desirable to heterodyne upward by employing a variable frequency oscillator of considerably higher frequency than the voice range. The frequency of this oscillator can be varied continuously throughout the range from about 11,000 cycles to 16,000 cycles, and the fixed frequency resonator is tuned to about 11,000 cycles. As translation of the wave under study to a higher frequency range reduces the percentage separation of the various components, it was necessary to choose a very sharply tuned resonating element. This takes the form of a steel rod which is loosely coupled magnetically to a driving circuit at one end and a registering circuit at the other. As the modulator used to accomplish the heterodyning process produces many frequencies other than the first order sum and difference terms, it has been necessary to choose the frequency ranges such that all undesired frequencies which can not be made extremely small will be well removed from the single difference frequency under observation.

The analyzer described in the paper by Landeen is capable of working over the range from about 3,000 cycles to 100,000 cycles. A requirement of this design was that very high resolution be obtained. To assist in accomplishing this end, the frequencies under study are translated downward in the frequency scale to the resonating element which consists of a circuit tuned to 800 cycles. This downward translation increases the

percentage difference of frequency separation of the components under study. Because of the great range of frequencies covered by the analyzer it is not possible to have sum and difference terms other than those of the first order fall outside of the range of sensitivity of the resonator. The modulator has therefore been so designed as to preclude formation in the higher order terms. To increase its discrimination, the analyzer makes use of two tuned circuits and amplifiers are ranged in tandem and placed before the modulator. The frequency to which these circuits are tuned must of course be variable and is set to coincide with the component under study.

Analyses of Heart Sounds,[17] by H. B. Williams, M.D.* and H. F. Dodge.† Certain sounds pertaining to the heart and lungs are heard in all normal persons. These normal sounds vary in quality and in intensity for different individuals, depending on the physical make-up of the particular organs producing them and also on the structure of bone and flesh through which the sounds are transmitted to the surface of the body. The paths along which the heart and chest sounds can travel to reach the surface of the flesh are many. Much of the energy never gets to the surface but considering the energy that is available at the surface for auscultation, there is always a path of least resistance from the source of sound. The end of this path is picked out by the physician when the point of maximum intensity is found with his stethoscope.

The first heart sound is believed to be due to vibrations set up by the heart muscle at the beginning of contraction. The second or diastolic sound is undoubtedly due to the closure of the semilunar valves. Studies have been made of the frequency distribution of the energy of normal heart sound as heard at the apex for ten male adults. This work has been restricted to a study of the energy embodied in the frequencies above

[17] Archives of Internal Medicine, Dec. 1926, Vol. 38, pp. 685-693.
* Columbia University, College of Physicians and Surgeons.
† Bell Telephone Laboratories, Inc.

50 cycles, a great portion of the energy being found in the band from 50 to 60 cycles. Indications of later work point out, however, that there is considerable energy below this point. The normal heart sounds of different persons have their own peculiar quality characteristics somewhat as various voices do and it is the variation in the distribution of the vibrational energy which determines the quality.

Since the ear is customarily employed for observing the heart sounds, the sensation value of the ear at any frequency must be taken into account and the true interpretation of heart sounds must be measured by the difference between the average heart sound curve and that of the threshold of audibility.

Aside from the consideration of quality, the relative intensity of normal heart sounds was observed for different persons. In a study made of twenty male adults, a ratio of 40 to 1 in sound energy was found between the loudest and weakest normal heart sounds for the persons in the group. Investigation of the energy and the frequency distribution of heart murmurs was also made, most of the energy being found in the region below 660 cycles.

Magnetostriction, by L. W. McKeejan.[1] This paper contains the principal part of three lectures given at the Franklin Institute in April, 1926. The history of investigations on the changes in dimensions which accompany magnetization and the changes in magentization which accompany forcible changes in dimensions is sketched and a classification of the rather complicated cases which have been examined is offered. The bearing of magnetostriction on theories of ferromagnetism is emphasized and a number of new experimental results are described. A representative bibliography is appended.

[1] Journal of the Franklin Institute *202* 737-773 (1926).

Notes on Recent Occurrences

THE PERSONNEL CONFERENCE

THE Personnel Conference held at Pinehurst, North Carolina during the first week in February was attended by a single representative from each of the Associated Telephone Companies and by Mr. Hall and Mr. Gherardi and the several members of their respective staffs whose assignments bring them closely in touch with Employee Representation Plans, interests and activities.

The purpose of this Conference was to take account of stock out of the experience of the Bell System with employee representation during the past six years and the discussions were restricted solely to this subject.

The method of procedure was founded on the assumption that within this group there was a fairly comprehensive knowledge of all phases and details of employee representation in the Bell System. Consequently, no formal papers were presented to the Conference but each topic was developed by spontaneous contributions and each problem or proposition was discussed until it had been considered from every viewpoint which could be brought to bear upon it out of the entire membership of the Conference.

It may be of interest to note and it certainly was significant from the standpoint of the results of the Conference that the total number of substantial contributions to the proceedings divided by the number of members in the group gave a quotient of 35, or an average of 5 major participations per individual during each day of the Conference program.

One result of this plan of procedure was unanimity of opinion throughout the group with respect to practically all the conclusions which were finally developed. One of the by-products which undoubtedly contributed to this result was the fact that this plan of procedure seemed to give each individual in the Conference a feeling that

he shared with the Conference leader the responsibility for finding the answer to each problem which was presented. In the last analysis the Conference resolved itself into a practical demonstration as far as method was concerned of how Joint Conference Committees could function most effectively in a Plan of Employee Representation.

The substance of the discussions of the Conference will be submitted to the officials of the Associated Companies and it is believed that adoption of such recommendations and suggestions as prove practicable to each operating company will serve to still further strengthen the good personnel relations which now obtain throughout the Bell System.

THE ANNUAL MEETING

At the annual meeting of the stockholders of the American Telephone and Telegraph Company, which was held at the headquarters building, 195 Broadway, New York, on March 29, the Directors were reelected. There were 7,167,746 shares voted by proxy or in person, which was the largest percentage of shares to be represented in the vote for many years.

Organization Changes

American Telephone and Telegraph Company

Karl W. Waterson appointed Assistant Vice-President

Entered employ of the Bell System as an Engineer with the American Bell Telephone Company in Boston, June 13, 1898; in charge of Equipment Engineering Department, 1901; in the Engineering Department of the American Telephone and Telegraph Company was successively in charge of Traffic Engineering Department, 1905, Traffic and Equipment Engineering Department, 1906; Assistant Chief Engineer, 1907, and Engineer of Traffic, 1909; Executive Officer, Development and Research Department, 1919; Assistant Chief Engineer, Operation and Engineering Department, 1920; Assistant Vice-President, March 1, 1927.

Southern New England Telephone Company

Edward H. Everit appointed Assistant to General Manager

Entered employ of the Bell System as an apprentice with the Southern New England Company, January 2, 1889; course of study in Boston with American Bell Telephone Company, 1889; leave of absence for electrical course at Columbia University, 1890; Superintendent of Equipment, Southern New England Telephone Company, 1892; Engineer, 1903; Chief Engineer, 1910; Assistant to General Manager, March 1, 1927.

Allerton F. Brooks appointed Chief Engineer

Entered employ of the Bell System as Engineer's Assistant with the Southern New England Telephone Company, June 26, 1911; Supervisor of Central Office Installations, Plant Department, 1913; Special Agent, Commercial Department, 1914; Commercial Engineer, 1915; Cost and Appraisal Engineer, Engineering Department, 1917; Plant Extension Engineer, 1926; Chief Engineer, March 1, 1927.

WESTERN ELECTRIC COMPANY, INC.

F. B. Gleason appointed General Commercial Manager

Entered employ of the Bell System as correspondent in the Western Electric Sales Department at Chicago, 1904; Manager at Dallas, Tex., 1908; San Francisco Manager and Pacific District Supervisor, 1909; Pacific District Manager, 1911; transferred to Nippon Electric Company as Far Eastern Manager, 1912; Assistant District Manager, Western Electric Company, Atlanta, 1916; Southern District Manager, 1916; General Contract Sales Manager, New York City, 1918; General Telephone Sales Manager, 1921; General Commercial Manager, February 1, 1927.

J. D. Kennedy appointed General Telephone Sales Manager

Entered employ of the Bell System as Engineer, Western Electric Company, 1899; in charge of Equipment Division at Chicago, 1907; Philadelphia Manager, 1909; Assistant Contract Sales Manager, Hawthorne, 1918; General Merchandise Manager, 1920; Superintendent of Equipment, Installation Department, 1922; General Manager of Distribution, Western Zone, 1926; General Telephone Sales Manager, February 1, 1927.